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Government
Publications

MACKENZIE VALLEY PIPELINE INQUIRY

IN THE MATTER OF APPLICATIONS BY EACH OF
(a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A
RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS
CROWN LANDS WITHIN THE YUKON TERRITORY AND
THE NORTHWEST TERRITORIES; and
(b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY
THAT MIGHT BE GRANTED ACROSS CROWN LANDS
WITHIN THE NORTHWEST TERRITORIES,
FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND
ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION,
OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE
PROPOSED PIPELINE

(Before the Honourable Mr. Justice Berger, Commissioner)

Inuvik, N.W.T.

January 22, 1976

PROCEEDINGS AT INQUIRY

Volume 114

CANADIAN ARCTIC
GAS STUDY LTD.

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APPEARANCES:

Mr. Ian G. Scott, Q.C.,
Mr. Stephen T. Goudge,
Mr. Alick Ryder and
Mr. Ian Roland for Mackenzie Valley Pipeline
Inquiry;

Mr. Pierre Genest, Q.C.,
Mr. Jack Marshall, and
Mr. Darryl Carter for Canadian Arctic Gas
Pipeline Limited;
Mr. Reginald Gibbs, Q.C.,
Mr. Alan Hollingworth &
Mr. John W. Lutes, for Foothills Pipe Lines Ltd.;

Mr. Russell Anthony &
Pro. Alastair Lucas for Canadian Arctic Resources
Committee;

Mr. Glen W. Bell and
Mr. Gerry Sutton, for Northwest Territories
Indian Brotherhood, and
Metis Association of the
Northwest Territories;

Mr. John Bayly
or
Miss Leslie Lane for Inuit Tapirisat of Canada,
and The Committee for
Original Peoples Entitle-
ment;

Mr. Ron Veale and
Mr. Allen Lueck for The Council for the Yukon
Indians;

Mr. Carson H. Templeton, for Environment Protection
Board;

Mr. David Reesor for Northwest Territories
Association of Municipal-
ities;

Mr. Murray Sigler for Northwest Territories
Chamber of Commerce.

Mr. John Ballem, Q.C., for Producer Companys;

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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. BALLEM: Good Morning Mr. Commissioner. I would now like to introduce the panel who will deal with the Imperial Oil proposed project, and they are Mr. Glenn Mainland and Mr. Barry Stewart. I understand that they have previously been sworn.

GLENN GOUDIE MAINLAND,

BARRY DEANE STEWART, resumed:

DIRECT EXAMINATION BY MR. BALLEM:

Q I would ask Mr. Mainland if he would briefly outline his professional and academic qualifications, first giving his full name and present occupation.

WITNESS MAINLAND: My name is Glenn Goudie Mainland. I am presently manager of frontier planning for Imperial Oil Limited.

Q Would you now proceed, sir, with your academic and professional qualifications?

A I graduated with a B.Sc. degree in mechanical engineering from the University of Glasgow in 1953. I am a member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta. My experience includes twenty years with Imperial Oil Limited's production research, technical service and research laboratory in Calgary working in areas of drilling, production and gas processing technology and concluding in with the position of Manager of Production

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Research. From August 1974 to the present time I have been manager of Frontier Planning, responsible for production-oriented planning activities in the arctic and off shore area.

Q Mr. Stewart, would you please tell us your full name and your present position?

WITNESS STEWART: My name is Barry Deane Stewart and I am reservoir~~engineer~~ inspection head with Imperial Oil in Calgary. I am a graduate of Queen's University in Engineering Physics in 1964. I've been employed by Imperial Oil since that time. Over the eleven years I have been involved in various assignments in reservoir engineering, natural gas engineering and natural^{gas} contract work. Currently I am in charge of a reservoir engineering section in Calgary. This section includes the evaluation of Arctic reserves held by Imperial Oil, I am a member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta and am a member of the Society of Petroleum Engineers of the C.I.L.

MR. BALLEM: Mr. Commissioner, I now propose to enter as exhibits the prepared evidence and also the volume of information support of land tenure agreement application. I would also make the comment that there are some slides in the evidence but they also are included in the evidence itself, so I do not propose to make an additional filing of those, if that is satisfactory. I will call upon Mr. Mainland then to introduce the prepared evidence.

(QUALIFICATIONS AND EVIDENCE OF MAINLAND AND

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STEWART MARKED EXHIBIT 419)

(INFORMATION RE LAND TENURE AGREEMENT,

TAGLU GAS DEVELOPMENT MARKED EXHIBIT 420)

Mr. Commissioner,
WITNESS MAINLAND: / I wish

this morning to provide an outline of the plans which Imperial Oil Limited has prepared for the development of the Taglu gas fields. The proposed Taglu gas development is to produce and process to specifications required by gas transmission lines, natural gas from the Taglu gas fields and possibly from neighbouring fields, if such fields are discovered in the future. Imperial's Taglu gas development will consist of two adjacent clusters of gas

THE COMMISSIONER: Excuse me, Mr. Mainland, is that the first slide, or? Oh, I'm sorry, all right. Go ahead, forgive me for interrupting.

A Imperial's Taglu gas development will consist of two adjacent clusters of gas wells, a gas plant and support facilities all grouped in one location just south of Big Lake on Richards Island in the North West Territories. While it's not on there, Big Lake would be just about the top of that slide. The gas field was discovered in 1971 and covers an area currently estimated at ten square miles. The reservoir is composed of multiple gas-bearing sands at depths between eighty-one hundred and 10,300 feet. The likely reserves are estimated by Imperial Oil at 2.7 trillion cubic feet and individual well production rates will be in the 35 to 50 million cubic feet per day range.

THE COMMISSIONER:

Q Is the 2.7, using Mr.

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Horsfield's categorization a minimum?

WITNESS STEWART : It is the

category lightly reserve, sir, which is probably a mean

assessment of the field. ^{WITNESS MAINLAND:} Development plans for Taglu are

still in the preliminary stage with the initial field
producing rate and hence the number of production wells

required still under investigation. The plant design

is modular, providing considerable flexibility in the

choice of plant size, which could be as small as .5

billion cubic feet per day, or as large as one billion

cubic foot per day. The construction decision on

the initial plant size will be based on the established

reserves at the time of making the decision and the near

term discovery forecast. Future expansions, however,

would be decided by the outcome of future exploration

and whether additional discovered reserves could be

technically and economically fed to Taglu for processing.

The plant can be expected to be in operation for a

period of over 20 years. The location of the proposed

development is shown in this figure. We favor this

location for the following reasons: Firstly, the well

clusters would be near the geographic centre of the field
enabling the wells to be deviated most efficiently.

That is to say that the well heads can be clustered

together in a small area and the wells radiated outward

effectively to produce a reservoir. Secondly the prox-

imity of the gas processing facilities to the production

wells eliminates the need for extensive gathering lines

roads and elaborate production equipment and facilitates

well inspection. No river channels need be crossed and

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the compact development system lessens any environmental impact. The transmission lines for the sales gas will be brought up to the plant by the pipeline owners. And, thirdly, the site is close to a navigable waterway and also therefore accessible by ice road. The land which we have applied for in our land tenure application will encompass the well clusters, the plant site, the dock, access roads, air strip and short above-ground flow lines. This land which amounts to about 200 acres is expected to remain in use for the life of the project. Possible future expansion of the facilities may require a small additional area as shown in the hatched areas on this figure. To a larger extent, however, land must be set aside for the approaches to the air strip runway, over on the left hand side, and safety areas around the dock and producing wells and for deployment of contingency equipment. Altogether, therefore, the gross area is estimated to be about 1000 acres as shown in this figure. Except for the net area actually occupied by the facilities themselves, the rest will remain essentially undisturbed.

The initial drilling program will comprise about 20 wells, 10 for each cluster. Each cluster will be situated on ^{an} elevated gravel pad, approximately 500 feet by 1600 feet including the drilling sump situated alongside. Each well will be drilled to approximately 10,000 feet in forty-five to sixty days; using only one rig the entire drilling program could take two and a half to three years of rig time to complete. We may elect to accelerate the drilling program by using a second rig if the project

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1 schedule lags ^{through} equipment delays or other reasons.

2 The drilling rig will be Arctic modified and cap-
3 able of sliding on the gravel pads. Hole-to-hole moves
4 will require the development of a moving system to skid
5 or roll the rig the 100 foot spacing between holes.
6 Development drilling operations will be similar to
7 exploratory drilling now taking place in the area.
8 Drilling material for three to four wells will be stock-
9 piled on-site to allow drilling operations to continue
10 through spring break-up and fall freeze-up, when the rigs
11 cannot be conveniently resupplied. Resupply material
12 will be stored at Bar C, our existing base camp. For a
13 20 well program, some 32,000 tons of drilling consumables
14 including fuel will be required.

15 The drilling of Taglu wells will generate drill
16 solids and drilling fluids removed from the drilling
17 mud to keep it well conditioned. The total fluid gener-
18 ated per well is expected to be about 35,000 barrels
19 with some 2,500 barrels of drill solids.

20 To limit the size of the drilling sump and facilit-
21 ate its eventual restoration, it is proposed to use a
22 subsurface injection scheme to dispose of a portion of
23 the drilling fluid. During the winter all liquids will
24 be emptied into the sump. The solids will settle out
25 after the spring thaw and the liquid will be re-injected
26 into the produced water disposal well which will be
27 drilled first on the pad. After development drilling is
28 completed the remaining sump contents will be allowed to
29 freeze within the sump and additional granular materials
and possibly insulation will be placed over the sump

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surface to ensure containment and provide a future work pad.

Current onshore practices in exploratory drilling place fluids in a sump excavated below the active thaw zone in the permafrost. In the the ice-rich soils of Taglu however, the large sump required could result in excessive thawing of the permafrost and possible failure of the sump. We are, therefore, proposing an above ground containment sump for each well cluster, consisting of a dyked area beside the drilling pad. The dyke surrounding the sump would be impervious to contained drilling fluids and also to keep flood waters out. Insulation will probably be placed within the dyke to keep the embankment frozen and thus maintain its structural stability. The well heads will be spaced 100 feet apart in a single row on each of the two drilling pads. This spacing is determined mainly by two considerations; first preventing complete thaw-back of permafrost between adjoining wells, and secondly, attempting to keep the size of the pads and hence the fill requirements and the impact on drainage in the surrounding area as small as possible. The proposed well design will have a permafrost thaw radius after twenty years production of from 15 to 25 feet over most of the 1,800 foot permafrost section as estimated by mathematical models. The thaw radius is influenced by the proximity of adjoining wells and closer spacing could result in coalescing or joining up of the thaw zones between adjoining wells. The consequence of this will not necessarily be serious, since because of the single-row arrangement the integrity of the

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permafrost around the wells in all other directions will be far less affected. One hundred foot spacing is considered conservative and closer spacing is possible. To maintain competence in the near-surface permafrost and ensure against surface slumping the top 60 feet around the wells will be permanently refrigerated.

A proposed well design is shown in figure 5. Below 2,100 feet, wells will be progressively deviated at a specified rate to a maximum total deviation angle of 50° . The drilling mud between casing strings in the top 2,000 feet will be replaced by gelled diesel to prevent casing failure due to freezeback in the annuli when wells are suspended, and also to minimize heat transfer to the permafrost during production. The surface casing which runs the depth of the permafrost will be sufficiently strong to withstand all permafrost-induced stresses. And I might just add a paragraph here to explain that well completion in some more detail.

Starting at the top we have the large diameter refrigerated conductor pipe, which will keep the ground around the well-head frozen. Then there will be 3,000 feet of 13 3/8 inch surface casing going right through the permafrost, which is about 1,800 feet deep at Taglu, and cemented in. Next there is a string of 9 5/8 inch production casing to about 8,000 feet. In most cases this will be deviated outwards beginning below the surface casing so that we can reach out into the reservoir. A seven inch liner will extend through the producing formation. Then there is the 5 1/2" tubing through which the gas will flow. The annulest between the tubing and

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1 production casing and also that between the production
2 and surface casings will be filled with gelled diesel
3 oil. This material will not freeze if the well sits
4 idle for a long period, which could damage the casing,
5 and it also acts as an insulator to slow the heat flow
6 from gas to the permafrost during the production phase.
7 The surface casing will be sufficiently strong to withstand any
8 stresses in the permafrost area, and in addition there
9 will be a subsurface safety valve to close off the flow
10 in case of any damage to the well or the flow line
11 equipment. Normally the well clusters will be operated
12 unattended. Simple systems will be used and key items on
13 each cluster will be monitored automatically. The well
14 clusters will be readily accessible from the process
15 plant and will be visited by operation personnel for
16 routine inspections which might be daily during the
17 initial operation period. Once the initial operation has
18 established that
19 equipment is performing properly, the visits will be made
less frequently.

20 In general, there will be little rig activity after
21 the initial drilling, for at least five years. After that
22 some remedial well work and infill drilling will
23 probably be needed. Workover frequency is estimated at
24 one to two workovers per year, with each workover lasting
25 15 to 45 days. Additional infill drilling will be
26 carried out as required and will be completed by about
27 the tenth year of production. The additional drilling
28 pad area required for infill drilling will be provided
29 during the previous winter. Whether such additional pad
30 area will be an extension of the existing drilling pad or at

a nearby location will be determined by the drilling and production characteristics of the reservoir. During normal drilling operations the number of personnel on-site is expected to be about 35 people. At such periods as cementing, running casing, logging, or moving, there could be as many as 55 personnel on-site.

Turning to the offsite piping, because of the compact nature of the Taglu gas development the offsite piping systems will be quite short. Most important off-site pipe lines will be the production flow lines linking the wells to the processing plant. Other pipe lines between the plant and the wells will carry water and liquid hydrocarbons removed from the raw gas for re-injection in their respective disposal wells, as well as refrigerant, methanol, and possibly corrosion inhibitors. In all cases the pipeline -- pipes will run above grade supported on piles frozen in the permafrost. A minimum elevation above grade will be maintained to protect the pipelines against any adverse effect from seasonal flooding and prevent thermal disturbance to the tundra by the pipelines. All lines will be insulated and designed to recognized codes and standards. Safeguards such as leak detection controls and automatically closing block valves will be provided, as well as clean-up equipment to ^{deal with} any hydrocarbon leakage. Pipeline construction including pile support will be carried out mainly from gravelled areas, but where additional working space was needed some activities will be undertaken in winter from the adjacent frozen tundra.

Going on to the process plant an analysis

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of the feed gas to the plant is shown in table 1. I haven't prepared a slide for that. It lists the components of the gas and incidentally there is an error in the table. Sharp eyes may have detected those numbers don't add to 100 percent. We are missing pentane and isopentane which together total .21 more percent which would bring it to 100. / THE COMMISSIONER:

Hands up -- those who noticed. Table 1 isn't here.

A It's in the back, yes, just ahead of the

figures. It's a typographical error. It is significant however in this analysis that no sulphur compounds are present. Gas processing will involve removal of excess water and liquid hydrocarbons from the raw gas and compressing and cooling to produce sales gas which meets the delivery requirements of the transmission line. The major by-products developed in the plant will be hydrocarbon liquids and produced water removed from the gas. Some of the hydrocarbon liquids may be used in the plant fuel system, the rest will be re-injected into the reservoir. The produced water will also be re-injected. Disposal wells will be specially completed at the cluster for this purpose. Major processing equipment will include heat exchangers, pumps, vessels, compressors for gas and propane, and gas turbine drivers for the compressors, electrical power generators, and a propane refrigerator system. The plant will be largely air cooled. Small equipment may require cooling water but this will be minimal and will be contained in closed systems. All major equipment will be located inside buildings. An allowance for some expansion will be built into the plant layout, and ground space will be

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1 provided for maintenance access to the units. The
2 plant will be designed so that only during plant start-
3 up and emergency shut-down will gas or liquids be
4 released to the flare system. Plant control will be designed
5 to reduce and/or shut off the plant feed before flaring
6 major volumes of gas would be required.

7 Liquid hydrocarbons will not
8 be flared. Instead these liquids will be released to
9 the main flare system and any liquids which do not
10 vaporize during this operation as a result of the
11 drop in pressure will be collected in the flare knock-
12 out drum and pumped to an emergency storage tank for
13 later disposal.

14 The height of the flare stack
15 will be the shortest possible, without adversely
16 affecting the permafrost through the emission of radiant
17 heat.

18 Tankage for the plant for stor-
19 ing water, hydrocarbon and other products will be
20 installed as early as possible. In this way their capa-
21 city will be used for the construction phase when a
22 large amount of diesel fuel will be needed. Current
23 estimates for total tankage is 40,000 barrels. A number
24 of the tanks will be completely fabricated and shipped
25 to the site by barge. The larger ones will be built
26 on-site, probably in summer and early in the project.

27 When the plant is operating,
28 all but the water and condensate storage tanks will
29 be restocked once a year from barge supplies brought
30 to the plant dockside. Present sizing specifications

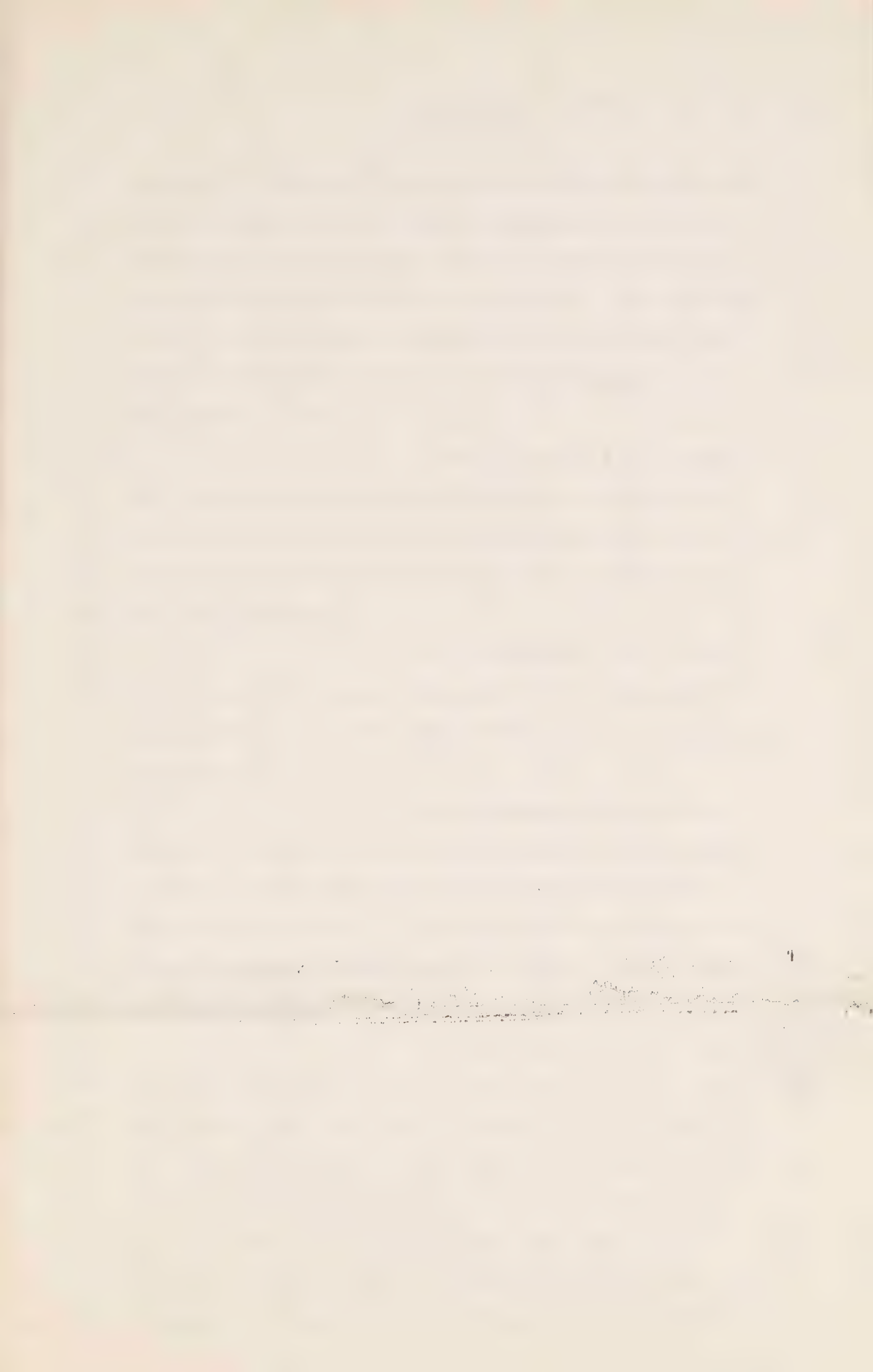
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1 call for each storage tank to have the capacity to
2 fill normal operating requirements for 16 months. All
3 liquids will be distributed by permanent piping. Piping
4 will be installed between the plant and the dock to
5 handle liquid supplies brought to the site during the
6 summer.

7 Plant operation will require
8 a number of support facilities, including roads, an
9 airstrip, a dock, tank storage, buildings such as
10 permanent housing and maintenance, utilidors and water
11 and sewage treatment systems.

12 Buildings, utilidors, pipe
13 supports, etc. would be founded on piles to ensure
14 against settlement. Heat-generating structures will
15 be elevated above the gravel surface to prevent degrad-
16 ation of the underlying permafrost. Both wood and steel
17 piles will be used, depending on the design requirements.
18 Piles will be placed in pre-drilled holes a few inches
19 larger than pile diameter and backfilled with either
20 a water-sand slurry or insulating material. Some
21 1,500 timber piles will be required, the source for which
22 could be the Fort McPherson area or elsewhere in the
23 Northwest Territories. A similar number of steel piles
24 will also be used.

25 Gravel pads will be provided
26 for the plant area, dock staging area, drilling clusters,
27 airstrip and parking, road and tank storage area. These
28 pads will be designed to protect the underlying perma-
29 frost and also to protect the facilities from annual
30 flooding. For areas such as the plant and drilling pads,



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1 insulation might be used within the pads and impervious
2 dykes constructed along their perimeters. The
3 feasibility of using sand cores to reduce the amounts
4 of gravel needed is being investigated. Under heated
5 tanks or warm floors on grade, natural cooling with
6 forced ambient air through corrugated ducts in the
7 pad might be used.

8 Gravel pads will be elevated
9 and drainage through them provided via culverts to
10 prevent water from ponding against the pads. Insulation
11 will be placed below culverts to prevent degradation
12 of the permafrost.

13 It is estimated that 1½ million
14 cubic yards of granular material will be required for
15 construction of gravel pads for the gas plant and support
16 facilities.

17 The primary source of select
18 material known at present is the esker and kame deposits
19 to the south of Yaya Lake, the location of which is
20 shown in this figure. These deposits are accessible by
21 barge in summer, and by truck along the frozen river
22 channels in winter.

23 We have made a detailed survey
24 of this source during the winter of '74-'75 to assess
25 the quality and quantity of material in the deposits.
26 Our current plan is to work the source essentially in
27 summer. This has been done in the past. The gravel
28 will be bladed off to thaw depth and pushed into
29 windrows in pits. When the water is drained from the
windrows, the gravel will be classified and stockpiled.

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1 Trucking will begin as soon as winter haul roads are
2 prepared and will continue through the winter. Some
3 granular material might be barged in summer to extend
4 the construction season.

5 Another source of granular mat-
6 erial is a sand deposit at Big Horn Point approximately
7 $3\frac{1}{2}$ miles north-east of the plant site, and also shown
8 on that map. The river here is flanked on the east
9 for a considerable distance by exposures of frozen
10 ground moraine, which are constantly being eroded, sorted
11 and deposited downstream.

12 A survey of this source during
13 the winter of '74-'75 has indicated a potential 1.1
14 million cubic yards of very fine sand located in the
15 river channel adjacent to Big Horn Point. Though the
16 material would be unsuitable as a wearing surface,
17 approximately 400,000 cubic yards might be used as a
18 core within the pads, which would mean that much less
19 gravel would be needed from the Yampa Lakes eskers. If
20 environmental, technical, and construction studies which
21 are now under way indicate that Big Horn Point sand is
22 a usable source, plans will be evolved for developing
23 the deposit.

24 Construction and operation of
25 the gas plant will require short access roads connecting
26 the plant facilities to the dock, airstrip, well clusters
27 and flare. These roads will be designed to provide all-
28 weather service. Road routes will be planned to
29 interrupt normal drainage as little as possible and keep

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the amount of fill required to a minimum. It is anticipated that traffic will be heaviest during the construction phase of the project.

With no year-round highway access in the Mackenzie Delta, air transport is the only means of regular rapid service to the site during non-winter months. Aircraft will be used to transport men and perishable goods, and for unscheduled equipment deliveries.

An airstrip will be built at Taglu for use by short takeoff and landing aircraft. The landing surface will be about 2,500 feet long and 80 feet wide. Critical airfield dimensions and runway lighting will conform to the appropriate Canadian Ministry of Transport Codes and Regulations. It is proposed the construction of air fields will be scheduled early for use during construction.

To effectively handle the many types of loads, especially the very heavy plant equipment, and to re-supply on-going operations after the plant complex is completed, a permanent dock will be built on the shore of the river channel. It is proposed to build the dock as early as possible for use during plant construction.

The size of dock will depend on the type of barge used as well as the schedule and co-ordination of delivery during the available barging period. The exact location and design of the dock will depend on further soil investigations along the river bank. The river channels at Taglu separate at the

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southern edge of the proposed site and may therefore provide a distinct advantage for barge manoeuvring.

A staging area, approximately 500 x 350 feet will be built behind the dock for temporary storage of unloaded construction materials.

Dock facilities will also include a fuel unloading installation, consisting of a docksite manifold arrangement with either onboard or shoreside pumps.

Hydrocarbons and liquid chemicals necessary for plant operations will be kept in a tank storage area located next to the process plant. The tank farm will be enclosed by an impervious dyke large enough to contain the entire capacity of all the tanks within it, as well as the maximum trapped precipitation that might be impounded. Transfer lines from the tank farm to the process plant will also be within a dyked area, so that in case of a line rupture, the spilled contents could be retained for cleanup.

A permanent housing complex with room for up to 100 people will be provided next to the plant. Permanent plant operating and maintenance staff will number about 65. However, the transient presence of workover crews, summer transportation crews, and visitors calls for additional space.

The warehouse, maintenance shop, and garage will be built as early as possible so that they could be used in plant construction. Present plans are to build the permanent housing complex before the arrival of the final plant modules, so that

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1 operations personnel can participate in the final
2 construction phases of the plant.

3 The Kuluarpak Channel of the
4 Mackenzie River immediately south of the plant is the
5 most likely source of fresh water. Water treatment
6 waste streams will be combined with the sewage-plant
7 effluent before being pumped back to the river. The
8 water treatment waste stream will contain returned river
9 silt and small amounts of consumed treatment chemicals.
10 Spent carbon used in polishing water for taste will
11 be incinerated.

12 The precise treatment process
13 for domestic sewage has yet to be selected but both
14 physical-chemical and extended aeration biological
15 systems are potentially suitable and are currently being
16 evaluated. The treated effluent would be disinfected,
17 pumped back to the river in a heated utilidor, and
18 injected through a submerged diffuser.

19 Some six to nine pounds of
20 solid wastes per capita per day will be generated during
21 both construction and operating phases of the project
22 from packaging, meals, reading materials, and consumable
23 office supplies. Miscellaneous construction wastes,
24 consisting primarily of packaging, crates and skids,
25 will add a daily amount which is as yet unknown. Sludge
26 from the sewage treatment plant will amount to approxi-
27 mately one pound per capita per day.

28 All solid wastes will be
29 collected in plastic bags and/or cans which will be
carried daily to the incinerator-feed storage area in

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1 the waste treatment building. Construction crates and
2 skids that can be reduced to suitable dimensions will be
3 trucked in periodically for incineration. Larger
4 construction wastes and scrap metal will be trucked
5 directly to the designated land-fill site at convenient
6 intervals. Sewage-plant solids will be centrifuged to
7 maximum concentration before being pumped from a hold-
8 ing tank to the incinerator.

9 Pre-construction activities
10 will be limited to surveying and soil sampling at the
11 jobsite and at the remote aggregate sources, and
12 measuring and testing of the river. In all cases,
13 this work will require only a few personnel who will com-
14 mute from existing camps in the delta or operate from
15 one camp at the site. The work will be done in both
16 summer and winter and will require very little equipment.
17 Transportation will be by fixed wing aircraft, helicopter,
18 boat and ground vehicles.

19 The project schedule in
20 figure 6 shows the key dates for construction. Assuming
21 a startup in the latter half of 1981, gravel at YaYa
22 Lake will need to be stockpiled in the summer of 1976.
23 Personnel working at the YaYa gravel pit will require
24 a small camp and support facilities. Site construction
25 beginning with gravel hauling and spreading, erection
26 of a temporary construction camp and support facilities,
27 and other sundry preparation facilities will start in
28 January, 1977. Gravel hauling might continue by barge
29 through the summer of 1977, but in any case summer
30 stockpiling and winter hauling and spreading of gravel

12

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1 will probably continue through to the summer of 1979.
2 The first phase of the main construction camp will be
3 installed during the winter of 1977-78, the balance in
4 the following winter. Some of the plant modules may be
5 installed in 1978. The bulk of the modules will be
6 installed in '79 or '80. The balance of the modules in
7 construction will be completed in 1981. The permanent
8 operations camp will probably be erected in the winter
9 of 1979 to '80 ready for startup in late '81.

10 Most plant equipment and
11 facilities will be prefabricated and shipped to the
12 site in large modules. These modules, some possibly
13 weighing up to 1,000 tons each, will be sized to fit
14 the transportation units available. The modules will be
15 transported to their site by barge and moved from the
16 dock to their final location by crawler-transporters.
17 Installation at the Taglu site will include interfacing,
18 testing and commissioning the prefabricated modules,
19 erecting buildings and installing the interconnecting
20 piping, controls and instrumentation from the wells
21 to the plant itself.

22 Modular construction is a
23 concept commonly used in offshore structures. It had
24 not been extensively used on land until the advent of
25 major construction in Alaska. Once the modules are
26 placed on their piles and enclosed, most of the other
27 work will be done indoors where heat and light are
28 available.

29 Based on maximum use of modules,
30 site construction will require at the most about 400

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1 specialized tradesmen. By contrast, a non-modular
2 construction approach would require 700 skilled trades-
3 men working in much less shelter under very difficult
4 physical and climatic conditions.

5 Construction equipment will be
6 much the same for an equivalent project elsewhere, ex-
7 cept that the use of modules will reduce the quantity
8 to some extent.

9 Various methods of transporta-
10 tion will be involved, recognizing that efficient
11 transportation of personnel, equipment, material, goods
12 and services is essential to the successful construction
13 and operation of the proposed project.

14 Ocean-going barges carrying the
15 larger, heavier modules will travel from the West Coast
16 to the Mackenzie Delta plant site around Point Barrow.
17 At the mouth of the Mackenzie River in Kugmallit Bay,
18 the barges will be lightered using river barges to re-
19 duce draft and enable a tow from Kugmallit Bay to the
20 Taglu site. On arrival at the plant site, the
21 modules will be off-loaded from the barges onto special
22 heavy-load crawler transporters, moved to their final
23 location and set on piles.

24 General bulk materials, equip-
25 ment, and small modules built elsewhere in the south
26 will be transported via the existing rail and road
27 networks to a riverside staging area in Hay River.
28 Here they would be loaded onto river barges and trans-
29 ported down the Mackenzie River directly to the plant
30 site.

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1 As far as possible, standby
2 units will be built into the design of the plant, but
3 certain large items might have to be replaced from
4 offsite locations. Plant replacements will be delivered
5 by barge or aircraft either to the site or to Inuvik.

6 The major portion of the annual
7 re-supply of heavy consumables, fuel, chemical and
8 non-perishable stores will be barged to the plant site
9 from the rail and road heads at Hay River and will
10 require no special barges or tugs.

11 Fuel will be delivered to the
12 site in conventional bulk fuel barges. Once the barges
13 are docked, fuel will be transferred via the re-supply
14 pipelines built for that purpose. Steel drums might be
15 used for certain liquids or chemicals not practicably
16 transportable as bulk cargo.

17 Non-perishable bulk items of
18 the plant warehouse stocks are likely to be transported
19 in freight containers that minimize loss and handling
20 at both the source and site.

21 Perishable goods and non-
22 scheduled items will be re-supplied by aircraft. Food
23 and similar commodities needed for the plant's accommo-
24 dation centre will be flown from Inuvik on a regular
25 basis.

26 Once on-stream, the Taglu
27 gas processing facility is envisioned as a locally
28 controlled operation, run from a central control room
29 at the gas plant. A sophisticated computer system will
30 be used to maintain production control of gas from the

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1 wells, optimize the gas plant process and undertake
2 routine surveillance and monitoring of key operations in
3 the whole production chain. With this type of control,
4 a minimum number of plant operators will be needed.

5 Equipment will be maintained
6 by personnel stationed at the plant site. Maintenance
7 workshops will be equipped to meet the day to day require-
8 ments of the mechanical, electrical and instrument
9 repair personnel, as well as those of special personnel
10 brought in for major mechanical repairs. Much of the
11 mechanical equipment in the plant will be duplicated,
12 and a comprehensive supply of replacements will be
13 maintained.

14 MR. BALLEM: Thank you, Mr.
15 Mainland. These witnesses are now available for cross-
16 examination by my friends.

17 MR. MARSHALL: I have no
18 questions of this panel.

19 THE COMMISSIONER: Could I
20 just ask you a question, Mr. Mainland?

21 Q You're describing a
22 project that will be developed on the basis of discover-
23 ies already made, that is the 2.7 at Taglu, that Imper-
24 ial estimates is likely to be found in the Taglu field.
25 What is in round numbers the capital cost of the
26 project? That is including the drilling of the producer
27 wells, the flow lines and other lines and the gas plant.
28 Is there a round figure you can give us?

29 A It's got to be a very
30 round figure. You may have noticed on the tentative

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1 design and construction schedule that is shown that
2 the definitive estimate for the plant hasn't yet been
3 made. In other words we don't have an accurate cost.
4 I think the best number I could give you is somewhere
5 between 500 and \$600 million.

6 Q Thank you.

7 A But that is, by the way,
8 we better get this right, that's in dollars in the
9 year in which they're spent.

10 Q You mean that's projected
11 over the --

12 A We call them current
13 dollars, but people get confused by these things so I
14 think if we express it as that way. In other words,
15 '76, '77, '78, '79 dollars. So we're having to estimate
16 inflation in there too.

17 Q You haven't?

18 A We have, yes.

19 Q Do you mind telling me
20 at what rate?

21 A It just isn't that simple
22 and I quite honestly couldn't because the construction
23 people when they do, apply different rates to construc-
24 tion materials, labor, transportation and all these
25 aspects.

26 THE COMMISSIONER: O.K. Well,
27 Mr. Hollingworth?

28 MR. HOLLINGWORTH: Thank you,
29 sir.

Mainland & Stewart
Cross-Exam by Hollingworth

1 CROSS-EXAMINATION BY MR. HOLLINGWORTH:

2 Q Gentlemen , I'm referring
3 you to the main large document, the information in
4 support of land tenure agreement application, more
5 specifically to the section on treatment of waste water
6 and sewage. Now have you established what type of system
7 you're going to use?

8 WITNESS MAINLAND: For sewage?

9 Q Yes sir.

10 A I think I earlier in my
11 testimony pointed out that we are still looking at the
12 type of sewage system that we will use.

13 Q So I take it from that
14 that you don't have a design as yet?

15 A No, we don't.

16 Q Is Imperial designing this
17 system itself, or will it look to a consultant?

18 A We are working with
19 consultants.

20 Q Which consultant are you
21 working with?

22 A We have been having advice
23 from our main consultants, Fleur, and as I pointed out
24 there are at least two systems that we can use. We will
25 have two separate systems, one for the main permanent
26 operations centre, and we'll also have smaller units
27 for the construction camp.

28 Q Now, taking into account
29 the material required for the gas plant, for the
30 construction equipment to construct the plant, the

Mainland & Stewart
Cross-Exam by Hollingworth

1 gathering lines, and the drilling that's going to go
2 on, have you any estimate as to the total tonnage that's
3 involved to get to the site?

4 A No, I couldn't give you
5 that.

6 Q And so I take it from
7 that that you 'd be unable to give me a total of
8 tonnages broken down by gas plant, construction equip-
9 ment, gathering lines and well drilling?

10 A No, our design work
11 isn't far enough along to be able to give you that.

12 Q Do you know when you're
13 going to be in a position to do --

14 A I imagine that's going
15 to be on the day that we decide what size plant we're
16 building.

17 Q Now have you, beyond the
18 table that's in the back of your prepared evidence,
19 have you any more detailed schedule for tonnage
20 shipments or for shipments generally?

21 A No, I don't. That's a
22 study which really we're about at the process of
23 initiating. We recognize that a shipment is going to
24 have to be an activity which is co-ordinated by other
25 users of transportation systems and we've really, I
26 guess, partly been waiting for our own design and
27 partly waiting for everybody else to undertake that
28 kind of study.

29 Q Well, I suggest to you,
30 sir, that the pipeline applicants are perhaps further

Mainland & Stewart
Cross-Exam by Hollingworth

1 advanced on figures such as this, and these figures
2 would be most helpful in planning and figuring out the
3 logistics system. I was wondering when you could give
4 us more details. Does it again revolve around the size
5 of the gas plant?

6 A Well, obviously it will.
7 I imagine sometime in this coming summer we're going to
8 know the range, depending on what size the plant is.
9 I certainly don't have those figures at this time.

10 Q What range would you expect
11 to see? You've got, as I understand it, a range for the
12 size of the gas plant as to the amount of gas it's
13 going to handle. What difference in tonnage do you see
14 between the smallest and the largest one contemplated?

15 A I couldn't tell you.

16 Q No idea at all?

17 A No idea at all.

18 Q Now apart from the modules
19 that you've made reference to, which weigh in the
20 neighborhood of 1,000 tons, and which you're going to
21 bring around Point Barrow by ocean-going barge, do you
22 know of any other material that's going to be brought
23 around Point Barrow?

24 A I wouldn't rule it out
25 but I doubt that that would be our major transportation.
26 I'm sure that when we load modules onto barges that
27 we're going to wish to use those barges to capacity, so
28 from that point of view I'm sure that there will be some
29 additional equipment on those barges but I couldn't
30 tell you.

Mainland & Stewart
Cross-Exam by Hollingworth

1 Q But you don't --

2 A Ton or amount.

3 Q -- you don't contemplate
4 having a barge other than one carrying a module carrying
5 equipment around Point Barrow?

6 A Not at this time.

7 Q Would the balance of the
8 equipment then be brought up the existing barging
9 system on the Mackenzie River?

10 A That would be our plan
11 just now.

12 Q And judging from one of
13 the tables in your evidence, I take it that that would
14 take place over a five-year period, or five-summer
15 period , referring to the tentative design and construc-
16 tion schedule?

17 A Yes, I think we show four.

18 Q Well, I'm looking under
19 "transportation" and I see figures in '77 and '78 for
20 construction camps, and I see a broken line in '78 for
21 modules --

22 A I'm sorry, I thought you
23 were referring to the modules. O.K., the overall span
24 is five years.

25 Q Can you tell me what the
26 broken line in 1978 for modules means as opposed to
27 the solid line for the remaining three years?

28 A That's a tentative.

29 THE COMMISSIONER: I couldn't
30 understand that. What do you mean "tentative"?

Mainland & Stewart
Cross-Exam by Hollingworth

1 A We may or may not wish
2 to move a module at that time. That would be our
3 earliest.

4 Q But you could move them
5 all within the time span indicated by the solid line?

6 A Yes, but they could be
7 moved later. Some of that will depend on delivery of
8 major equipment.

9 MR. HOLLINGWORTH: Q I take it
10 from that, then, that you could move all the modules
11 in three years if you chose to, but that you might take
12 four years to do it.

13 A I believe that's right.

14 Q Once you have your granular
15 base in place, have you an estimate as to how long the
16 gas plant and the gathering lines, exclusive of the
17 wells, will take to put in place?

18 A I'm hesitating on that be-
19 cause putting the pad, etc., in place is, you know, is
20 spread over a number of years. As you can see, you know,
21 we haul and spread gravel material working out from
22 the areas which we need first in the way of dock ,
23 access road, airstrip, etc.

24 Q Well, all right, let's
25 assume then that you have your pad in place for the
26 area where the gas plant will be. How long will it take
27 to put the gas plant in place after that?

28 A I'm just trying to be sure.
29 It's three to four years.

30 Q Have you any estimate as to

Mainland & Stewart
Cross-exam by Hollingworth
Cross-Exam by Bayly

1 the quantity of fuels to be used? You might have given
2 that in evidence, I'm not sure.

3 A Fuels to be used?

4 Q During the construction
5 phase.

6 A I believe we have a number.
7 I haven't got it immediately available. It's certainly
8 an estimate, as all these are.

9 Q Could you let me have
10 that through your counsel?

11 A Yes, I can let you have
12 that.

13 MR. HOLLINGWORTH: O.K., I have
14 no other questions, thank you.

15
16 CROSS-EXAMINATION BY MR. BAYLY:

17 Q Following up on the ques-
18 tions that Mr. Hollingworth has asked you gentlemen,
19 and with regard to the system that you contemplate using
20 to bring materials in for the construction of your
21 gas plant, you've talked about contemplating using the
22 existing barge system, and we've heard some evidence
23 from the Arctic Gas and Foothills applicants that
24 they plan to use this system too, and they've had some
25 preliminary discussions, or at least Arctic Gas has,
26 with N.T.C.L. in which they gave an indication to the
27 barging company of how much material they would contem-
28 plate transporting, and therefore projecting how
29 much barge use they would have, and have you had
30 similar discussions with the carrier?

Mainland & Stewart
Cross-Exam by Bayly

1 A We have had some discuss-
2 ions. I think possibly the words I used in terms of
3 existing barge system might be misleading, but I think
4 what we meant there really was existing barge route,
5 and obviously it may be necessary to for instance
6 construct additional barges, or certainly to ensure
7 that the barging companies will be capable of handling
8 our material, and as we have in the past in our explora-
9 tion process we'll need to inform them in sufficient
10 time to have that capability ready.

11 Q And have you --

12 THE COMMISSIONER: We have
13 been told, Mr. Mainland, by the Arctic Gas people that
14 to enable them to bring all of their pipe, equipment,
15 material and supplies to each site along the route of
16 the pipeline, it would be necessary to double the
17 capacity of the existing fleet of tugs and barges on
18 the Mackenzie River system. That is a doubling of
19 capacity that would have to be developed by the time
20 the project got under way. If the Taglu project
21 was under construction at the same time, and presumably
22 there will be a great deal of overlap here. It
23 would be necessary to know to what extent the capacity
24 of the system will have to be enlarged to accommodate
25 Imperial, Gulf and Shell in the development of these
26 projects. So their question is an important one.

27 A We agree with you complete-
28 ly, Mr. Commissioner. The co-ordination of the trans-
29 portation on the Mackenzie is going to be most important.

MR. BAYLY: Q And you've said

Mainland & Stewart
Cross-Exam by Bayly

1 that in the backup volume to your application, and
2 expressed some concern without really expressing
3 solutions at page 2-7, and the paragraph there indicates
4 that you would believe,

5 "because several of these projects may go on
6 concurrently, some traffic congestion would
7 be expected. By far the largest impact on
8 transportation would be from the Mackenzie
9 Valley Pipeline, and this pipeline project
10 is expected to procure and operate its own
11 transportation system."

12 That wasn't the understanding we got from the applicants,
13 although they indicated they might have some of their
14 own facilities. They indicated they had been talking
15 to commercial carriers with a view to hauling a signi-
16 ficant percentage of their material in that fashion.
17 Is that changed since we last spoke to them? Have you
18 had communication with Arctic Gas and Foothills on this
19 subject?

20 A I couldn't give you details,
21 Mr. Bayly, but I guess what we're expressing is that
22 they are certainly going to speak for the transportation
23 equipment they need, as they evidently have been with
24 N.T., and co-ordination with the pipeline builder and
25 the other gas plant constructors is going to be ^{an} absolutely
26 essential activity for us within the next year.

27 Q All right, and when you
28 say "within the next year" the schedules that have
29 been suggested in your evidence mean that you don't
30 just have to start talking in the next year, you want to

Mainland & Stewart
Cross-Exam by Bayly

1 start barging in the next year and a half, so^{if} the mater-
2 ial has to be shipped on new barges somebody has to
3 start to build those before the summer of '77, which is
4 when you contemplate starting to move material. Is that
5 not correct?

6 A We have very little moving
7 in the summer of '77.

8 Q All right, so you
9 wouldn't contemplate the use of barges until --

10 A We might have some but
11 not a great deal over our present needs. We presently
12 ship a certain amount of material down the Mackenzie
13 and our additional load in the summer of '77 wouldn't
14 be excessively heavy.

15 Q Would you contemplate
16 having your own transportation system?

17 A I would doubt that very
18 much.

19 Q Have you discussed the
20 logistics of using Fort Simpson rather than Hay River
21 as a starting point, or have you not got that far?

22 A We haven't got that far.

23 Q So those communities don't
24 know whether there would be the additional impacts of
25 your staging from there as well as the applicants at
26 this point.

27 A Correct.

28 Q When will they know?

29 A I'm not sure that I can
give you a firm answer on that, Mr. Bayly.

Mainland & Stewart
Cross-Exam by Bayly

1 Q All right, how about
2 an estimate?

3 A I'm trying to derive an
4 estimate.

5 Q Would your company have
6 one that you could supply through your counsel?

7 A No, I don't believe so.
8 If we look at the schedule we are looking at major
9 shipments in '78. Obviously we would have to have
10 things arranged for at least a year ahead, as you
11 pointed out, so that I would think that they would be
12 aware of our plans by early '77.

13 Q And I take it that it
14 isn't just a question of the applicants for facilities,
15 but there is a considerable amount of regular traffic
16 to supply the communities down the Mackenzie and in the
17 Mackenzie Delta region that might well find stress on
18 facilities that they have come to count on from the
19 common carrier.

20 A Mr. Bayly, we recognize
21 that as something which we certainly have to take into
22 consideration.

23 Q All right, and have you
24 thought about the possibility that because of these
25 stresses that prices will go up because of the need
26 by the carrier for new equipment and have you thought
27 of making arrangements to mitigate this?

28 A We certainly have recog-
29 nized that danger and we believe that the best way in
30 which we can mitigate it is by giving adequate warning

Mainland & Stewart
Cross-Exam by Bayly

1 and making adequate arrangements with the transportation
2 companies so that overloading situations such as you've
3 described will at least have a minimal chance of
4 occurring.

5 Q Now, when you talk about
6 moving a large amount of equipment, as I understand
7 from the evidence we heard from Mr. O'Rourke, you
8 negotiate the rate with the carrier and hope to get
9 a better rate than their general one because of the
10 volumes that you're shipping. Is that correct?

11 A Most transportation systems
12 have some variable charges based on the amount you're
13 shipping, I would think.

14 Q And have discussions as
15 to this --

16 A No, we haven't at this time
17 discussed rates with the transportation companies.

18 Q Now, in your application
19 and in the material that you have put before us today
20 you talk about the acreage that you will require. That's,
21 I think, illustrated in figure 2 at the back of the land
22 tenure application. I believe it's approximately 1,000
23 acres.

24 A O.K. I guess it's the
25 same as figure 3 in my presentation today.

26 Q Now, that area is predi-
27 cated on the use of this cluster system about which we
28 have heard a great deal both in the press and in your
29 evidence.

30 A Correct.

Mainland & Stewart
Cross-Exam by Bayly

Q And you're able to use this cluster system in this particular area, I gather, because of the kinds of formations that you have found the gas in. Is that correct?

A Yes sir, and the depth at which it's found.

Q And if we compare your application with that of Shell, we find that they have not felt they were able to do that. Their application does not request permission to build a cluster system, but a conventional well and feeder line system, and they say that that's because of the structures; is that correct?

A Mr. Bayly, I prefer really to leave Shell to discuss their plan, but my understanding is it's basically because of shallower formation.

Q Yes, I don't want to go into the reasons in detail. I just want to make it known through you that there are other ways of proceeding which maybe dictated by the depth of the gas and to some extent by the formations.

A Correct.

Q And in this particular location you don't face those problems.

A That's correct.

Q Now, that appears to be true for the present application. Can you with assurance tell us that you won't have to go to the system that Shell has opted for, if you either expand the field

Mainland & Stewart
Cross-Exam by Bayly

1 around Taglu or move to other parts of Richards Island
2 or the Tuk Peninsula or other portions of the delta
3 where you have leases?

4 A No, I couldn't give you
5 that assurance because you've introduced, for instance,
6 other possible discoveries and of course I can't
7 tell you now whether they'd be deep or shallow. At
8 Taglu itself, it depends what one means by "assurance".
9 Whenever you start drilling into the ground, "assurance"
10 becomes a slightly tenuous word. We certainly have,
11 to the best of our belief, we should have no problem
12 in Taglu in drilling from these clusters. I did mention
13 in the testimony today that if we wish to drill some
14 more wells, whether we would tack them on the end of
15 the present planned clusters or as shown in this figure
16 3 today, add an additional pad, is open to a later
17 decision.

18 Q So even in the Taglu discovery
19 and in the development of it over the projected 20-year
20 period you cannot say with certainty at this point
21 whether the cluster system can be used in the entire
22 development of this deposit?

23 A I'm as certain as I can
24 be from the wells that we've drilled that we can use
25 the cluster system at Taglu, yes.

26 Q When you say you're as
27 certain as you can be, we have to accept, though, that
28 you don't know everything about this deposit and haven't
29 made that decision of whether to step out with another
well or to build a new cluster.

Mainland & Stewart
Cross-Exam by Bayly

1 A I'm not quite sure if I
2 understand what you mean.

3 Q Your diagram 3, you say,
4 contemplates a possible new cluster system.

5 A Right.

6 Q That may not be the way
7 you would elect to go when you came to expanding it.

8 A That's correct, because
9 after we have drilled 20 wells in that field, obviously
10 we are going to know more about the sub-surface condi-
11 tions in the whole field than we do presently, and
12 that might say that we would be better to add that
13 extra pad and drill the wells from there rather than
14 simply add onto the end of the existing pads.

15 Q So you may have a system
16 of feeder lines at Taglu within the next 20 years,
17 depending on what you find in the first 20 wells.

18 A I don't really believe we
19 have a system of feeder lines. We might have an
20 additional pad.

21 Q And they would -- then
22 there would only be one feeder line from that pad back
23 to the gas plant.

24 A Yes sir, in relatively
25 close proximity.

26 Q And this, though, we would
27 have to restrict to this particular plant. We don't know
28 about what you would have to do in other parts of this
29 region.

30 A That's correct.

Mainland & Stewart
Cross-Exam by Bayly

1 Q You might be forced to
2 do what Shell has proposed?

3 A That's right, Mr. Bayly.

4 Q Now, on page 2-4 of the
5 land tenure application --

6 THE COMMISSIONER: Mr. Bayly,
7 before you go on, when you come to the later stages in
8 the life of the gas field and you have to resort to
9 what you call infill drilling, are you likely then to
10 have to abandon the cluster? Can you answer that?

WITNESS STEWART:

11 A Yes. No, we would not have
12 to abandon the cluster concept, as was displayed on the
13 chart this morning, we feel we can deviate wells up
14 to a 50-degree angle and this would enable us to get
15 very extensive coverage of the reservoir, which is
16 9,000 feet deep, and we could achieve at least as good an
17 aerial coverage in a reservoir as we do under convention-
18 al drilling from this central location. So we would not
19 visualize any need from a reservoir mechanic's point
20 of view to go away from the central pad concept for
21 drilling.

22 THE COMMISSIONER: Thank you.

23 MR. BAYLY: Q When we're talking
24 about the development of this region as an area from
25 which gas will be extracted, I take it you're faced with
26 the problem of either building a gas plant at each
27 discovery, or of running feeder lines from new discoveries
28 to existing gas plants. Is that correct?

29 WITNESS MAINLAND: Yes, that's
30 correct.

Mainland & Stewart
Cross-Exam by Bayly

1 Q And I take it you haven't
2 made the decision of whether you might use the Taglu
3 gas plant as the processing facility for discoveries
4 outside the area that you've shown in figure 3 in your
5 evidence.

6 A We've certainly consider-
7 ed that possibility. The sort of factors which would
8 determine whether we could or not would be the location
9 of the discovery, basically the location of the discovery
10 and the nature of the gases or fluids that we found.

11 Q And you would then be
12 faced first of all with extensive additional costs if
13 you decided to go the route of building a new gas plant,
14 or the problems involved that you've outlined in running
15 flow lines to the existing gas plant.

16 A Yes, there's development
17 costs one way or the other.

18 Q Is one more expensive than
19 the other? I realize that this depends on distances to
20 a certain extent.

21 A Distances and the fluid
22 composition. One might, you know, have a hybrid system
23 with partial processing and it's hard to tell. You
24 know, it's so hypothetical that really I can't give you
25 a firm answer. We wish that we could. It would make
26 our planning easier.

27 Q All right, but for the
28 sake of the people that live in this area, over the 20-
29 year period they can't find out from you at this point
30 whether you would be running lines into the Taglu plant

Mainland & Stewart
Cross-Exam by Bayly

1 from other discoveries, or whether you would have
2 additional gas plants located in the region.

3 A We couldn't tell them
4 that, and certainly I'm sure before these further
5 developments took place there would also be processes
6 of application and approval.

7 Q As I understand one of
8 the concerns in Alberta from an environmental point of
9 view has been systems of flow lines and is that the
10 reason that you are attempting at least in this
11 particular project to use the cluster system, or is it
12 a question of economics?

13 A Oh, we've had several
14 reasons for looking at the cluster system, basically
15 in the area where we are, we wish to minimize the amount
16 of granular materials that we are going to use, and
17 the area that we're going to cover with them. The
18 cluster drilling system permits a good deal of
19 economy from that point of view, and there's no doubt
20 also, of course, that apart from saving granular materials,
21 it also is a more economical way to go since they're
22 expensive to obtain and place. We believe also the
23 environmental impact is reduced when it is possible to
24 go to this kind of scheme.

25 Q Now, on page 3 of your
26 evidence you said that the land applied for will
27 encompass the well clusters, plant site, etc., and then
28 you say:

29 "Possible future expansion of the facilities
30 may require a small additional area as shown

Mainland & Stewart
Cross-Exam by Bayly

1 in figure 3."

2 A Those are those hatched
3 areas.

4 Q And that is within the
5 perimeter of the dotted line?

6 A That's correct.

7 Q And using the scale it
8 looks like it's approximately 5,000 feet by 5,000 feet
9 at the most.

10 A Sorry, Mr. Bayly, you're
11 referring to the gross area?

12 Q Yes, the gross area of
13 development that you've outlined.

14 A I believe that works out
15 to about 1,000 acres.

16 Q Yes. Now, given what
17 you've said about the possibility of using the Taglu
18 plant, depending on future discoveries to refine what-
19 ever you find there, it is possible that more than the
20 1,000 acres would eventually be used at least to bring
21 gas into the plant. It may not be probable, but it's
22 at least possible, according to your evidence.

23 A I'm sorry, I'm not sure
24 if I fully understand what you mean. To bring gas into
25 the --

26 Q That's right, you talked
27 about the possibility of using the Taglu plant--

28 A Right.

29 Q -- to process gas brought
30 in by feeder lines, depending on the distances, the kind

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1 of gas, whether it could be processed in this plant.
2 So if that were the case, this dotted line containing
3 1,000 acres would not necessarily be the total
4 extent of land in this area that would be used or
5 disturbed in one way or another.

6 A Well, there would
7 certainly need, obviously, to be room for a gathering
8 line to come in.

9 Q All right. Looking at the
10 deposit as you see it now, do you see the necessity
11 building up at some point in the future for taking
12 another area adjacent to this one to develop another
13 part of this field?

14 A No, I see no possibility
15 of that.

16 Q Now you talked about
17 infill drilling and I'm afraid I didn't know what that
18 phrase meant. Perhaps you could explain that.

19 WITNESS STEWART: Mr. Bayly,
20 the infill drilling is a term we use to describe wells
21 which are drilled during later stage of the production
22 life of a field as opposed to initial drilling or
23 initial round of wells. The reason for this is that
24 the productivity for deliverability from individual
25 wells will be the highest at the earlier stages of
26 the field production life, because of the higher reser-
27 voir pressures. Ultimately you'll need more wells to
28 deliver the same total field production rate, and all
29 the term "infill drilling" means is a drilling of
30 wells within the field at a later of stage of depletion

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1 in order to keep the contract grade up. We use that
2 term as opposed to delineation drilling which takes
3 place early in the field life in which you are defining
4 the extent of the deposit.

5 Q All right. Well, could
6 they be outside this thousand acres that has been
7 delineated?

8 A No sir, the point we were
9 making a moment ago was that at the surface these wells
10 would still be located on pads, the surface locations
11 will be clustered but they could be deviated in sub-
12 surface such as to spread out in a reservoir which is
13 9,000 feet below the surface.

14 Q So we can expect that any
15 infill drilling would take place within the perimeter
16 that's been described and that it would take place on
17 pads as close to the existing plant as is practicable.

18 A Yes, that's exactly our
19 plan.

20 Q And we have no idea how
21 many of these wells will be required at this point.

22 A Not exactly, sir. This
23 depends on the total production rate you would wish to
24 take from the field, the productivity characteristic
25 with individual wells as the field is depleting, and the
26 economics of extending the production rate as the
27 field pressure declines. We cannot give any exact
28 number at this time.

29 Q And not knowing that,
30 you wouldn't have included the amount of gravel possibly

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1 needed for these pads in your granular requirement
2 estimates

3 A Perhaps Mr. Mainland can
4 give you those details. I would just say that from
5 my way of thinking it would only be the possibility of
6 one more pad as shown in the diagram that would be
7 required for this. The exact number of wells that
8 we would then have on the possibility of three pads
9 is, you know, there's a minor variation on it, a pretty
10 major thing.

11 Q But would it be a pad
12 of similar dimensions to the ones that's been placed
13 on this figure?

14 WITNESS MAINLAND: I would
15 think the spacing would be similar, Mr. Bayly, so
16 the pads would be comparable, depending on the number
17 of wells that had to be drilled.

18 Q You wouldn't contemplate
19 more than one additional pad but you can't say at this
20 point how large that pad would be.

21 A I wouldn't anticipate it
22 would be any larger than the present pads, if one
23 wants to look on them as a standard.

24 Q Given industry practices,
25 would it be the practice to build that pad incrementally
26 or all at once? Would you build 100 feet of it and
27 put down one well, and then build^{out} another 100 feet;
28 or would you guestimate what you would need and build
29 a big pad and then put wells on it?

30 A I recognize your question

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1 and I suspect we would build it incrementally.

2 THE COMMISSIONER: Mr. Stewart,
3 you're an expert, you're a reservoir engineer and
4 an expert on gas reserves. Given the capital cost
5 of this plant, I take it that it is located, bearing
6 in mind what your best estimate is, of the location
7 or the likely location or probable location of further
8 discoveries of gas in the delta, is that --

9 WITNESS STEWART: No sir.

10 Q -- and the Beaufort Sea ,
11 is that true or not?

12 A No sir, this specific
13 plant has been located with the knowledge of the Taglu
14 field specifically in mind. It is by far the major
15 discovery made to date, and we have located it in the
16 centre of that field to facilitate this cluster con-
17 cept that we talked about a moment ago. There has been
18 no consideration of the location of the plant in Taglu
19 where other discoveries might take place.

20 Q I see, so if there were
21 no likelihood at all, no possibility at all of finding
22 further discoveries in the delta or the Beaufort Sea,
23 that's where you would ^{have} build this plant.

24 A I think that's a fair
25 statement, yes. It's more the sizing and the design
26 concepts that might change on the anticipation of other
27 discoveries, as opposed to the physical location from
28 a reservoir engineering point of view.

29 THE COMMISSIONER: Yes, I
30 understand.

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1 MR. BAYLY: Mr. Commissioner,
2 I'm about to move to another topic and wonder if this
3 is coffee time?

4 THE COMMISSIONER: Yes, it is.

5 (PROCEEDINGS ADJOURNED FOR A FEW MINUTES)
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1 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

2 MR. BAYLY: Q Mr. Mainland,
3 could you tell me whether you are aware of the regula-
4 tions in Alberta that an applicant for a processing
5 plant should list an alternate site for the proposed
6 plant?

7 WITNESS MAINLAND: I'm not
8 personally aware of that, no.

9 Q Mr. Stewart, is that
10 something within your knowledge?

11 WITNESS STEWART: No.

12 Q I understand that's a
13 fairly recent regulation that exists. We don't have
14 a regulation in the Northwest Territories to that
15 effect, as I understand it. Is that your understanding?

16 WITNESS MAINLAND: Certainly not
17 that I am aware of.

18 Q Now, your background
19 material suggests that you looked for and chose what
20 you thought was the best site.

21 A That's correct.

22 Q And did you look at other
23 sites and list them in any order of priority if it
24 should happen that that site was not available to you
25 for any reason?

26 A No, we haven't looked --
27 when I say we have looked at alternate sites, early
28 on in the development planning the three companies
29 were interested in looking at the possibility of
30 combining fluid streams in a plant, and so we looked at

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1 the problems of conveying our gas from Taglu, for some
2 distance to another plant, and in the process carried
3 out some engineering work that evaluated the line
4 sizes and pressure drops and this type of thing, and
5 fairly early on found that to encounter a major river
6 crossing with a raw gas line handling Taglu gas, resulted
7 in a problem of slug flow, and pressure build-up in
8 the line which made it certainly undesirable. The
9 pressure drop would require relatively early compression
10 from the field, so we were then going to be in a
11 situation of really having two sets of facilities, one
12 at Taglu at the wellsites and another at the plant
13 itself, and our opinion then was that we would really
14 have less impact on the overall area by combining the
15 wells and the plant at the one location and maintaining
16 things like short flow lines which are advantageous
17 in minimizing the area taken up by our facilities.

18 Q If it became necessary
19 because of government regulation, would it be possible,
20 in your opinion, to still tap this gas reservoir and
21 place the plant outside that thousand acres that you
22 have delineated in figure 3.

23 A We could put some of the
24 plant outside. We couldn't put all of the plant. We
25 would have to maintain some facilities at the wellsite
26 to ensure that we could, for instance, condition the
27 gas in a way that would allow us to pipe it without
28 major problems.

29 Q I take it, though, you
30 couldn't move the wells very far?

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1 A We can't move the wells,
2 no.

3 Q Can you~~not~~ move them at
4 all, or is it a question of not being able to move them
5 far enough to be significant?

6 A No, we might -- Mr.
7 Stewart might correct me -- we might move them 1,000
8 feet or so, but not appreciably, not far enough away
9 to make any real difference to the plant.

10 Q So to tap that reservoir
11 you have to be right there with your wells.

12 A With the wells, yes, Mr.
13 Bayly.

14 Q Now, when you talk at
15 page 2-14 of your land tenure application, land tenure
16 material, you talk about, at the top, about the location
17 of various facilities on the site, and those don't
18 include the gas plant. They only include ancillary
19 facilities for waste disposal, etc.

20 A Is this right at the top
21 of the page, sir?

22 Q You've stated that:
23 "However, the detailed discussions later in
24 the application will mention the approximate
25 location of various facilities..."

26 and we couldn't find that anywhere in this volume. Have
27 you provided that somewhere else?

28 A Well, I think that what's
29 referred to there is that the plan which we've shown
30 and which we have also used today indicates the approxi-

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1 mate location -- by "approximate location" I'm meaning
2 within a few hundred feet one way or the other -- for
3 instance one thing that is not absolutely fixed and might
4 be moved is the location shown for that flare stack,
5 it might be better to be in the area which is shown on
6 figure 3 in today's evidence for the expanded flare.

7 Q That's the round dot --

8 A Yes.

9 Q -- line area.

10 A That's correct, it might
11 be better to move it across the other side, so there are
12 details like that in which they probably won't be fixed
13 until we really get down to final design, but are not
14 going to really appreciably affect ^{the} actual area taken
15 up or the overall impact. It's simply a re-arrangement
16 of facilities inside this general area.

17 Q And would this re-arrange-
18 ment be done on environmental as well as economic and
19 engineering grounds?

20 A Well, the whole plan that
21 we have now has been one which has evolved taking into
22 account the environmental considerations. As I mentioned
23 things like the drilling sump and pads, dykes, etc.,
24 are all designed for environmental reasons. I'm not
25 sure that any of the re-arrangements would be specifi-
26 cally and environmentally oriented at this time.

27 Q Well, if some of these
28 facilities are located to within a few hundred feet
29 and we've heard Dr. Bliss' evidence that says that there
30 may be changes that -- in topography that are fairly

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1 dramatic in a few feet or even a few inches, have you
2 yet said "the best place for waste disposal or a sump
3 is where we put it on this map because somebody's gone
4 out and surveyed the soil conditions," or have you
5 not got to that stage yet?

6 A I think things are fairly
7 uniform in that part of ground. Now when I say
8 "uniform" biologists might correct me, but I don't
9 believe that there are major changes in that area.

10 Q All right, you have
11 shown on figure 3 something that looks like it might
12 be a lake. Is that what it is?

13 A I believe that's a low
14 spot there.

15 Q All right.

16 A When I say "low", the
17 overall topography doesn't vary more than a few feet
18 in that part of the country.

19 Q But you have -- you
20 heard Dr. Bliss' evidence and you did have your biolo-
21 gists on the ground to help you choose the sites for
22 the facilities outlined in this area?

23 A They have certainly been
24 on the ground. I'm not sure that they've been hand in
25 hand with an engineer at the time, but they have seen
26 our plans, yes.

27 Q Have they done soil and
28 ice content tests to help you locate these facilities?

29 A We have done soil and ice
30 content tests, yes.

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1 Q And --

2 A They have been basically
3 from an engineering design consideration to help us
4 determine the type of insulating material or pads we'll
5 have to build and to start to give us estimates of the
6 type of piling that would be required.

7 Q -- has somebody looked at
8 the drainage in this area to see whether or not there
9 may be problems with drainage around or under any of
10 the pads that you have projected on this diagram?

11 A The final drainage patterns
12 have not yet been finalized. I think that the relief
13 across the site that we're looking at is maybe one or
14 two feet.

15 Q And I take it when you
16 say "it has not yet been done" that despite the fact that
17 you say the relief is not dramatic, that they will have
18 to be done before final location?

19 A Certainly.

20 Q And have you had your
21 river people looking at the dynamics of channels that
22 are on the perimeter of the area to see whether or not
23 the facilities you plan adjacent to the channels
24 are likely to be in jeopardy from either ice or
25 flood waters?

26 A Yes, we've had some
27 work done on the hydrology of the area.

28 Q And is that just the
29 river hydrology, or does that include the possibility
30 of storm surges inundating the land where the plant is

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1 located?

2 A It includes the possibility
3 of storm surges and that consideration is one of the
4 design criteria for the dyking which we would put around
5 the facilities.

6 Q Now, have you estimated
7 the maximum height already that you would have to build
8 your dykes, or are you not at that stage yet?

9 A Yes, we have, and it's
10 approximately eight feet. If you'll accept that, that's
11 not absolutely accurate, but it's in that order of
12 eight feet.

13 Q And that takes in your
14 estimate of maximum river discharges and maximum
15 storm surge possibilities?

16 A That's correct.

17 Q You've shown an extension
18 on the runway that you have put on this map. Is there
19 a reason for that?

20 A One of the decisions we
21 had to make is in what sort, what type of aircraft would
22 be used, and presently we plan to use something like
23 a Twin Otter. There are some tradeoff, and I'm not an
24 expert on this, maybe the man sitting next to me is
25 more so, but there's some tradeoff between using a
26 smaller aircraft more often, or a little larger aircraft
27 less often. The only reason for that dotted area on
28 the end there is to allow for that possible balance.

29 Q All right, and that dotted
30 line -- it's hard to say but it looks like you might be

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1 extending a 2,500-foot runway an additional 500 feet.

2 A That's correct.

3 Q Now, turning to page 2-43,
4 you speak there in the second paragraph -- do you have
5 a copy of this, Mr. Commissioner?

6 THE COMMISSIONER: Yes. I'm
7 with you.

8 MR. BAYLY: You speak about
9 extreme emergencies when the plant could not be de-
10 pressured over a reasonable period, and the possibility
11 of having to vent over^a short-term gaseous hydrocarbons
12 into the atmosphere. Now, you talk about reporting
13 these to the appropriate authorities, and I assume that
14 would be after the venting, if it was an emergency.

15 A That would be. However,
16 I believe that as our plans evolve and since this
17 particular application was written, the possibility
18 of us using a venting system, if it hasn't disappeared,
19 it virtually has.

20 Q You would put in whatever
21 equipment was needed to allow you to vent, if you did
22 run into an extreme emergency that you hadn't been able
23 to calculate for.

24 A I believe our feeling is
25 that we should be able to adequately flare the volumes
26 required rather than vent at the plant.

27 Q All right, now is there
28 any way of your predicting ahead of time, not an extreme
29 emergency, but the necessity to flare or to vent
30 under any circumstances?

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A Mr. Bayly, do you mean in terms of predicting tomorrow morning we may need some sort of thing, or --

Q Yes, or within an hour or within half an hour.

A There would be some such occasions, yes, where a component was known to be in such condition that we would wish to shut down part of the plant and depressure it.

Q Now, if you had to vent, and there were people in the area that got in the way of this escaping gas, I take it it could be very dangerous.

A My understanding is that there would be no danger on the ground. The gas would rise sufficiently to be quite clear of the ground.

Q So your venting occurs through vents that are pointed at the sky.

A That is correct.

Q All right. Now, I realize that you've said that at the present you have found no sulphur in the gas, or sulphur compounds in the gas, but assuming that sulphur compounds either were found in this gas or assuming that the deposit went sour, or that you were bringing gas from somewhere else that was not sulphur-free, into the Taglu plant, then venting into the atmosphere might be dangerous not only to people but to plants and animals.

A Depending on the quality and type of gas, I suppose it could be.

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Q And we've had evidence from Dr. Bliss that hydrogen sulphide, for example, is very toxic for lichens, for other plants as well but particularly for lichens. You're aware of that?

A I believe he was talking about sulphur dioxide, but yes.

Q I'm sorry, sulphur dioxide. Would you contemplate that this might be dangerous to people using these channels which are adjacent to the area outlined in the dotted line in figure 3?

A Well, I think we should clarify first of all that, as I've mentioned, our plans at the moment do not include venting. Certainly we would not be venting sour gas in such a way as to endanger anybody near the plant, in or near.

Q Except in a grave emergency where the plant itself might be in jeopardy and the personnel on it.

A We operate gas plants in Alberta handling sour gas and in them have procedures that obviate the need to vent sour gas in an area.

Q So you don't feel there would be any threats to people who might use the area of the channels for boating or transport in the winter?

A No, I don't.

Q We've heard some evidence from you with regard to your requirements for gravel, and sand, possibly, and at 2-52 of your application you talk about sources and quantities of granular material, and at the third paragraph you mention a detailed survey

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made in '74-'75, the results of which will soon be available. Now we haven't seen the results of that yet and I'm wondering whether that survey has produced results that are available and could be given to us for assessment.

A Let me go into a little background of that study. Recognizing the need for some quantification of granular resources in the area, we had discussions with the Department of Indian Affairs & Northern Development on gravel surveys. They had plans to carry out some surveys at that time, or just before that time and were unable to do so since they had an inadequate budget, apparently, and we undertook to try to organize a grouping of companies to carry out the survey, which we did. We carried it out under an Arctic Petroleum Operators Association project. As you are probably aware, most of the APOA projects have some form of confidentiality clause in them simply in order to get people to participate, since there is really no reason why Company B should subscribe funds that Company A is going to do the work and put it on the table. So this study was carried out by a number of companies and we have just at this time sent a copy to the Department of Indian Affairs & Northern Development which will assist in their look at the regional granular material supply. We have a confidentiality clause which runs out on December 31, 1976.

Q I appreciate your concern for the protecting of the corporate participants in the study. However, you appreciate, I take it, that

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1 there are other potential users for gravel in the future
2 from this area that are concerned that whatever you
3 require is not going to make it impossible for them to
4 do other things with this material.

5 A Oh, absolutely, and I
6 think I can certainly say that the gross amount of
7 gravel was ascertained^{at} about nine million yards.

8 Q All right, and the --

9 THE COMMISSIONER: IN the
10 YaYa Lake eskers?

11 A That's right, sir.

12 Q And your requirements,
13 you said, were something like one million yards.

14 A 1½ million.

15 Q I notice that Shell
16 presumably intends to use the YaYa gravel deposits too,
17 and their requirements are probably very much along the
18 same lines as your own. They were part of the group
19 that paid for this survey, I suppose.

20 A That's correct, sir.

21 Q And Gulf as well?

22 A Yes.

23 THE COMMISSIONER: Well, Mr.
24 Bayly, if you think it's vital to get this document
25 -- this survey -- you could ask Mr. Scott to see what
26 he can do about it.

27 MR. BAYLY: I will, Mr. Commis-
28 sioner. I've asked him for documents before and he's
29 done his best without much in the way of results.

30 (LAUGHTER)

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MR. SCOTT: Well they're easier getting a document from a government because ^{if} Mr. Bayly wants it he can ask for it right now, to start us off.

MR. BAYLY: Well, I'd certainly like it. My clients aren't part of that agreement but --

MR. SCOTT: Don't talk to me, talk to Mr. Ballem.

MR. BAYLY: Mr. Ballem, would you investigate and see whether there's any way of having that released that your companies would agree with?

MR. BALLEM: Yes, I'll be happy to undertake to make that investigation, Mr. Bayly.

THE COMMISSIONER: The document, though, shows currently that there are nine million cubic yards of gravel in the YaYa Lake esker, and we'd all feel better if we had a nine-volume study confirming that. I mean that goes without saying, doesn't it?

MR. BAYLY: My only concern, Mr. Commissioner, maybe Mr. Mainland can offer this up without breaking the confidentiality. We've heard evidence that there is gravel and there is gravel, some of which is usable for some things and not for others. When you're talking about nine million cubic yards, I take it this study has assessed the kinds of gravel, the sorts of aggregates and the suitability for the purposes to which the producers and the pipeline applicants would put it?

A There are obvious --
sorry, Mr. Bayly. Yes sir, as you point out, there's

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obviously gravel and gravel, and I guess we prefer to refer to it as granular materials. I can't tell you offhand what percentage of that would be called select material. My guess is that it's 50% or so. There's just two things involved in granular deposits. One is, is their quality, and the other is how easily they can be mined or quarried, whatever the correct term should be.

MR. SCOTT: I understand Mr. Ballem will look into it, but surely if Mr. Bayly wants it, then we should at some point resolve that question as to whether he should have it. It seems to me that the feature of confidentiality as outlined by the witness has presumably served its purpose. That report was made confidential so members of the Association could be induced to cough up money to have a study done, it being understood that they wouldn't get the results if they didn't cough up money. Well now the coughing up of money presumably is over. They either signed on for the study or they didn't, therefore --

THE COMMISSIONER: Let's let Mr. Ballem look into it and if he finds this is a dry well, then Mr. Bayly can pursue it if he wishes to. Mr. Bayly's clients are interested for a number of reasons, one of them is that they -- for the land claim and presumably simply knowing the extent of the gravel deposit may not be sufficient, they might want to know more about it. All right, carry on. I think we were back to you again, Mr. Bayly.

MR. BAYLY: Q Now, we left off,

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1 Mr. Mainland, with you giving us an estimate that
2 perhaps half of that is select materials, and I take
3 it from your application that a portion of your granular
4 requirements are for select materials, but that you
5 could make do with other materials for the core of the
6 pad, for example, if it was well-insulated.

7 A That's correct. We believe
8 that as basic policy where we can obtain adequate fill
9 material that is not first-quality, that we should try
10 to do so and that's been the reason for our looking at
11 these deposits at Big Horn Point.

12 Q Now, and I'll be coming
13 back to those deposits at Big Horn Point in a few moments,
14 but I understand that sand is not the only possible
15 material that could be used to cut down your granular
16 requirements, and that my information is that the Russians
17 are using ice as a core material, insulated and surrounded
18 by select and good well-drained material to cut down
19 on their requirements. Have you investigated that through
20 your company or through this --

21 A Well, our requirements,
22 of course, are two things. One is to protect the
23 permafrost. The other one to obtain sufficient elevation
24 from a flood point of view. Some of that we can achieve
25 by using dykes instead of raising the entire area
26 sufficiently high for floods; but basically what we're
27 trying to do is protect an area which has a great deal
28 of ice in it already and if we were to try to use ice,
29 we would then have to continue to put a similar type
30 of insulation on top of that to protect it. So I don't

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1 really think that we would be very far ahead in terms
2 of saving on the materials.

3 Q All right, you didn't
4 investigate it, though?

5 A No sir.

6 Q Now, one of my concerns
7 with regard to the YaYa Lake deposits is that you
8 state in your evidence on page 16 that you'd need to
9 begin stockpiling the gravel in the summer of 1976 if
10 you're going to keep on your projected startup date of
11 late 1971 -- I'm sorry, 1981. I'm assuming then that
12 you would want to start taking this gravel before your
13 agreement with regard to this report runs out at the
14 end of 1976.

15 A No, I don't believe that's
16 a factor. That isn't why we wish to start taking gravel
17 in the summer of '76.

18 Q Oh, I'm not suggesting
19 it is, but it means that any public assessment of that
20 report were kept secret until 1976 --

21 A Well --

22 Q -- it could not take place
23 until after you'd begun to take gravel to stockpile, is
24 that fair?

25 A -- we will have to have
26 permission to take the gravel, and as I have mentioned
27 to you, we have just passed the report to DIAND so
28 they're also aware. I don't think there is any apprecia-
29 ble advantage to us from that point of view.

30 Q And have you requested

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1 permission to take gravel from the YaYa Lake esker
2 to stockpile, and have you made a land use application?

3 A We have, of course,
4 taken gravel from YaYa for a number of years for
5 various purposes. I'm not sure that an application for
6 this particular operation has yet been applied for.

7 Q Would you contemplate
8 making a land use application prior to approval of the
9 project?

10 A Do you mean for the gravel?

11 Q That's right.

12 A We would have to take
13 that gamble of applying for our land use permit for
14 the gravel and stockpiling it so that should we have
15 approval, we could make use of it. If we didn't get
16 approval, of course, then the work that we put into
17 the gravel stockpiling, windrowing-stockpiling, would
18 be lost. I understand that the operation would have
19 to be repeated on it to make it worthwhile for use
20 at a later date.

21 Q But you're prepared to
22 take that gamble.

23 A That appears to be
24 necessary in order to maintain the sort of schedule,
25 yes sir.

26 Q And I take it that you
27 may be making other land use applications for permission
28 to go ahead with other things prior to approval, the
29 other deposits you're looking for.

30 A We're still discussing

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1 -- are you referring to Big Horn?

2 Q Yes.

3 A We're still discussing
4 that entire question and as you may realize, we are
5 also in the process of proceeding through an environ-
6 mental assessment review process with the Department
7 of Indian Affairs & Northern Development, and the
8 Department of the Environment, and that would be part
9 of that discussion with them.

10 Q But not only are you
11 looking at the Big Horn Point area, but you did make
12 a land use application, I understand, for that which has
13 been deferred for a period of months; is that correct?

14 A We made a land use
15 application in order to be able to survey the material
16 that was there.

17 Q And that has -- I'm cor-
18 rect in my facts that that has been delayed for a period
19 of some six months, the consideration of that application,
20 is that correct?

21 A I'm not aware of that,
22 sir.

23 Q Now, the sand that you're
24 surveying on the Big Horn Point, is on the river banks
25 and in the river bed; is that correct?

26 A That is correct, sir.

27 Q And if we look at page
28 2-53 of your Taglu large green volume, you state there
29 that the applicant's survey of this source has indi-
30 cated a potential of 1.1 million cubic yards.

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1 You've further said that the amount that you would
2 contemplate requiring would be approximately 400,000
3 of those cubic yards.

4 A That's right.

5 Q And that hasn't changed?

6 A Not that I'm aware of.

7 Q Now, on the next page you
8 talk about various methods of removing and transporting
9 this sand if you were given permission to do so, and
10 one of these is to hydraulically dredge the sand from
11 the river bottom and to hydraulically pump and place
12 it into gravel -- or I assume that means sand -- into
13 dykes that are surrounded by gravel, or constructed of
14 gravel.

15 A Constructed of gravel.

16 Q And another one is to
17 excavate it from the bluff by the side of the river.

18 A That's correct.

19 Q Now, and the third method
20 is to combine those two operations together and to
21 move it you say conventionally, which I assume means by
22 truck or barge, is that correct?

23 A That's right.

24 Q Now, my understanding of
25 this particular spot is that it is an over-wintering
26 site for Arctic cisco. Are you aware of that, sir?

27 A We have been having fish
28 studies done at the site, yes.

29 Q Now, when you say you
30 have been having fish studies done, are you aware of

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1 the results of those studies?

2 A I would have to leave
3 that to the environmental panel to respond to in detail.
4 I don't know details of that study.

5 Q Will they be aware of
6 that then?

7 A I would think they will,
8 yes sir.

9 Q All right, perhaps if they
10 aren't, they could make themselves aware of that because
11 I'll be following this up with them.

12 I take it your environmental
13 panel has been paying attention to the evidence that
14 has been adduced from the applicants to build the
15 pipeline with regard to the state of knowledge on
16 Arctic ciscos, among other ^{Arctic} species.

17 MR. BALLEM: I don't think this
18 panel can respond to that enquiry.

19 THE COMMISSIONER: No.

20 MR. BAYLY: Perhaps they can't.

21 THE COMMISSIONER: The point's
22 been made and if that panel is here --

23 MR. BAYLY: Yes, perhaps they
24 could address themselves to that because I'd like to
25 address some questions to them on that particular
26 species of fish at this location and I don't want them
27 to be surprised.

28 MR. BALLEM: Well, we appreciate
29 your letting us know, and we'll do the best we can.

30 MR. BAYLY: Q Now, when you

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1 made your application or sorry, when you make your
2 application to take gravel from the YaYa esker, which
3 I assume you will do at some point prior to this spring,
4 will you have in your possession an inventory of the
5 granular resources available so that you are assured
6 that this is the best one economically, environmentally
7 and in terms of the other potential demands on this
8 source of gravel?

9 A That's a very tall order,
10 sir, to have a complete inventory of gravel resources
11 in the area. We will be as well equipped that way as
12 we can. However, we understand for instance that the
13 Department of Indian & Northern Affairs is currently
14 carrying out some more test drilling and that may turn
15 up some other materials. I think the fact that we have
16 been looking for material at Big Horn Point indicates
17 that we have a sincere interest in trying to minimize
18 the use of high-grade materials where we can use
19 something else.

20 Q Would you contemplate the
21 possibility of having to stockpile material from Big
22 Horn Point before you obtained approval for the project?

23 A No, I don't believe that
24 that situation would occur. I believe that initially
25 our need is for some gravel. This material would be
26 used as core and we would -- in a gravel pad and we'd
27 have to have something around about before we start
28 laying sand down.

29 Q Well, am I missing some-
30 thing or doesn't the core go into the inside?

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A It does, but it's surrounded
by gravel.

Q So you lay a sheet of
gravel -- or a depth of gravel and put the sand on top,
and gravel on top of that.

A There's certainly a form
of dyke around it, yes.

Q And what you would be
applying for then in early 1976 would be that permit
to stockpile gravel for the initial pad, the initial
depth on which the sand would be placed.

A And some working surfaces
to, you know, to begin the early work at the site.

Q And a working surface is
a road or a place to run equipment.

A That's correct.

Q I understand that you're
also requesting permission to take quarry material from
the Campbell Lake area for the construction of an
artificial island.

A We have been investigating
possible sources of rock material for possible off-
shore island development. We at present have
no plans for the use of that material. The work we've
been doing is contingent to try to discover where such
material might be available. We looked at two sources,
one being Campbell Lake, another one being on the Yukon
coast.

Q Well, perhaps you would
put a different interpretation on it. I have a letter

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1 here from Imperial Oil to the Department of Indian
2 Affiars, the attention of Mr. D. Longlitz signed by
3 Mr. C.R. Rankin in the Land Operations Department.

4 A Yes.

5 THE COMMISSIONER: What's the
6 date of the letter?

7 MR. BAYLY: Beg pardon?

8 THE COMMISSIONER: The date of
9 the letter.

10 MR. BAYLY: The date of the
11 letter is December 9, 1975, sir, and perhaps it would
12 be convenient if I were to read that into the record,
13 and you may wish to comment on it.

14 MR. SCOTT: Do you have a copy
15 of it, Mr. Bayly?

16 MR. BAYLY: I just have the
17 one but I will make copies available after lunch.

18 THE COMMISSIONER: Well, go
19 ahead and read it.

20 MR. BAYLY: It says:

21 "Dear Sir: Re: Campbell Lake Quarrying Site
22 and Related Facilities

23 You no doubt are aware of some success in the
24 discovery of hydrocarbons in the shallow offshore
25 water in the Beaufort Sea, as evidenced by our
26 Adgo discovery. Further offshore exploration,
27 exploratory wells are being planned. It is only
28 reasonable for us to expect some further success
29 and we must plan accordingly. Whenever hydro-
30 carbons are discovered that lie offshore in the

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1 Beaufort Sea we believe that the most economical
2 way to develop them would be to construct a
3 permanent artificial island on which development
4 drilling would take place and subsequent produc-
5 tion facilities. At the moment we plan to order
6 some five to \$6 million worth of equipment in order
7 to quarry and haul riprap material to be used on
8 the slopes of the island in order to maintain
9 the integrity of the island. We would not wish
10 to be put in the position of having ordered the
11 material and subsequently learning that we would
12 not be issued with the appropriate approval to
13 quarry the material required. We attach in
14 duplicate a land use permit application, together
15 with six prints of a plan showing a revision to
16 our original proposal as held under land use
17 permit No. N-73L637."

18 THE COMMISSIONER: Excuse me,
19 would you read the sentence before that?

20 "We would not,"
21 something or other.

22 MR. BAYLY: Yes sir.

23 "We would not wish to be put in the position
24 of having ordered the material and subsequently
25 learning that we would not be issued with the
26 appropriate approval to quarry the material
27 required."

28 Starting again after the number of the land use permit,

29 "We also attach our cheque in the amount of
30 \$770 to cover the fees involved. Also attached

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1 is a copy of a 2-page memorandum entitled,
2 'Campbell Lake Quarry.'

3 Another page entitled,

4 'Sequence of Events'

5 and a time graph showing the schedule for
6 quarry operations at Campbell Lake, most of
7 which is self-explanatory. In the late spring
8 and summer of 1975 we spent a considerable
9 sum of money to determine if it would be
10 economical to quarry riprap material from
11 Mount Sedgewick in the Yukon Territory. We
12 also studied the possibility of economically
13 building concrete blocks at Kings Point, using
14 local gravel. Harbor facilities were also inves-
15 tigated for economical and practical feasibility.
16 It was concluded that facility construction
17 would be twice the cost of those at Campbell
18 Lake. In addition the weather and offshore
19 ice problems around Kings Point would make
20 operations difficult and have a severe cost
21 impact. We have also looked for sources on,
22 as far south as Arctic Red River, and were
23 unable to locate suitable material. Having
24 concluded that the only economical source for
25 riprap material is at Campbell Lake, we thought
26 it best first to talk to Richard Fyfe of the
27 Canadian Wildlife Service in Edmonton to
28 identify any concerns that he would have with
29 respect to peregrine falcons in the area of
30 the proposed activity. It was our understanding

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1 that he would not object as long as the summer
2 activity was outside a 2-mile radius from the
3 nearest falcon nesting site. Also that
4 quarrying and site preparation activity would
5 be limited to the period November to April, and
6 that the summer activity would be limited to
7 barge loading from the stockpile adjacent to
8 the river channel. With reference to the
9 map attached to the application we would draw
10 your attention to the change in location of
11 the rock storage area to have -- to use the
12 former storage site would have meant that
13 any --"

14 I'm sorry,

15 "that we would have to use the river channel
16 as part of our access route. Any hauling by
17 wheeled units would then be limited to and
18 be dictated by the ice conditions, Not only
19 would this consume some unnecessary time
20 constraints, it also does not remove the
21 concerns we have for the safe operating,
22 bearing in mind the heavy loads involved
23 (60 tons). You should also appreciate that
24 the quantity of riprap has escalated to more
25 properly reflect our projected needs. At
26 the moment our plan only calls for this
27 material to be used as slope protection on
28 permanent artificial islands that will be
29 built in order to drill and produce the under-
30 lying hydrocarbons. It should be stressed that

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1 one of our first concerns is that of maintaining
2 the integrity of any permanent islands. Riprap
3 material from the Campbell Lakes area will
4 satisfy that requirement. Pending further off-
5 shore discoveries you can see from the schedule
6 that we may have to order some equipment by
7 May, 1976. Between now and then further money
8 is being spent on the design of the project.
9 Both of these expenditures are at risk if we
10 are not granted the land use permit and the
11 quarrying permit. The equipment to be ordered
12 is expected to cost five to \$6 million. We
13 would want assurance that the entire project
14 would obtain your approval in principle not
15 later than April 30, 1976, so that we can
16 order the equipment and proceed with more
17 definite plans. We already have a quarrying
18 permit No. 73-53 for which we have prepaid
19 royalties in the amount of \$6,000. It is
20 requested that you continue to hold that
21 money in trust in that it will be applied to
22 a quarrying permit that will be required at
23 a later date for a greater quantity of material.
24 The fees paid in the existing land use permit
25 will be recovered from your office at the time
26 it expires. Should ^{you} require any further information
27 please advise."

28 And it's signed, as I say, by Mr. Rankin.

29 It appears that then an appli-
30 cation has been made for a permit to quarry in the

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1 Campbell Lakes area, is that correct?

2 A That's correct, Mr.

3 Bayly. I think as you note in that correspondence,
4 what really Mr. Rankin is trying to determine is whether
5 a plan such as outlined to quarry rock would be allow-
6 able before we would continue with any further plans
7 for developing offshore slope protection by that
8 means.

9 Q Now, the site, according
10 to the map that is attached -- and I'll make copies of
11 that available as well -- appears to be within the
12 proposed I.B.P. site which is marked on the map, and
13 you're aware of that?

14 A I'm aware of that, yes.

15 Q And I'm assuming that you
16 have made all attempts possible to avoid the I.B.P.
17 site by using other sources.

18 A That's why we went to
19 Mount Sedgewick, yes sir.

20 Q And that isn't possible?

21 A To go to Mount Sedgewick?

22 Q Yes.

23 A We have environmental
24 constraints on that use also.

25 Q All right, I'm not suggest-
26 ing that you don't, I'm just -- what you have said in
27 this land use application is that if you build an
28 artificial island in this area the only convenient place
29 to get material that will act as a perimeter for these
30 islands is in the Campbell Lakes area, is that correct?

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1 A It's the only one other
2 than Mount Sedgewick that we ^{have} identified at this time;
3 apart from the environmental constraints, we did have
4 a feeling that the Campbell Lake site being near
5 Inuvik would also supply some local employment in the
6 area.

7 Q Now, you're more concerned
8 with the source than with the employment, I would take
9 it though, because you've gone to a great distance to
10 try and find an alternate source.

11 A I think we have a genuine
12 concern for local employment also, Mr. Bayly.

13 Q I'm not saying you don't.
14 But your primary concern was to find the best material
15 in the closest location. I'm not saying that's a bad
16 thing, I'm just saying that's what you were looking for.

17 A We were looking for a
18 suitable source , yes.

19 Q And you want to know by
20 this spring whether or not you can get that permit.

21 A We always would like to
22 have our plans as clear as possible.

23 Q Well, it's more than that,
24 isn't it, sir? You've said you want to order five to
25 \$6. million worth of equipment to carry out your plans,
26 and if you're going to buy that equipment you have to
27 know by this time whether you're going to get permission
28 to use this site.

29 A I don't recall the exact
words, sir, but I think it's that we 'might' purchase.

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Q You do say in the first page:

"At the moment we plan to order some five to \$6. million worth of equipment."

And you say on the second page:

"The equipment to be ordered is expected to cost five to \$6. million."

What you're saying is the way I should interpret that, is that it might be ordered.

A That's correct, sir.

Q But if you were going to take this material and use it you'd need that equipment.

A That's correct.

Q And you've disclosed this to the Department of Indian Affairs so that they will know that you're prepared to go to considerable expense and want a decision from them so that you can decide whether to buy this machinery.

A Yes.

Q Now then, when we're talking about granular materials in the area of the delta, Richards Island and the Tuk Peninsula, and when we're talking about select materials, although we can point to the YaYa esker and say, "There are nine million cubic yards," when it comes down to needing something particular for, in this case an artificial island, there aren't very many sources in the area which are economical and suitable.

A Are you --

Q I'm asking you.

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1 A -- asking me to endorse
2 that? There are obviously restrictions on materials.
3 I'm not sure that I'd use the term "granular materials"
4 for the Campbell Lake.

5 Q Let's call it in this
6 case riprap, which is what you've described it as.

7 A Yes.

8 Q And so riprap is at a
9 premium in this particular area, for the purposes to
10 which you wanted to put it, which is to build an
11 artificial island.

12 A I'm not quite sure what
13 you mean by "at a premium" but there are certainly not
14 very many sites where rock is available, yes.

15 THE COMMISSIONER: I think this
16 is an argument and you've made your point.

17 MR. BAYLY: My concern is, sir,
18 that you may want to build islands in the future and we
19 have heard from Mr. Horsfield that the potential of
20 the Mackenzie Basin may well lie offshore, the bulk of
21 it may well lie offshore, and if I were to suggest to
22 you that that would involve building more of these
23 islands, would you agree with me?

24 A That's highly probable,
25 yes sir.

26 Q And if you were building
27 more of these islands, you would need more of this kind
28 of material.

29 A That would be, in our
30 opinion, the best way to build them. It isn't necessarily

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the only way but it is best.

Q All right.

THE COMMISSIONER: And -- go ahead.

MR. BAYLY: Go ahead, sir.

THE COMMISSIONER: Well, the point that is being made, as I understand it, is that you have already found it necessary to seek to extract granular materials from this I.B.P. site, and given the tendency of future drilling as outlined by Mr. Horsfield into the sea, the technology that you used so far is, these man-made islands, then you're going to be making further inroads into that I.B.P. site and perhaps other sites because those are the places you have to go to and you can't bring granular materials from the YaYa esker. I just want to make sure I understand the point being made here, and there doesn't seem to be a great deal of dispute between Mr. Mainland and you, Mr. Bayly, about this.

MR. BAYLY: I'm not suggesting there is.

THE COMMISSIONER: No.

MR. BAYLY: Q I wonder if you could comment on the question put to you by the Commissioner?

THE COMMISSIONER: Well, it wasn't a question. Do I understand what is being discussed here, that's all?

A I think, sir, that the restrictions on available materials of this type are

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fairly universally acknowledged in the delta area.

MR. BAYLY: Q And if we were taking the prediction farther it might be that an application to build^A further island would include a land use application for further quarrying in the Campbell Hills area, the Campbell Lake area.

A Yes, it might.

THE COMMISSIONER: Is the Campbell Lake site one of the sites that the group of scientists who proposed these sites said should be protected absolutely from pipeline and related activity, or was it of the lesser category? Do you remember, Mr. Bayly? Dr. Peterson is beside you, he surely can tell you.

MR. BAYLY: I understand from Dr. Peterson that it was one of the most highly protected categories.

THE COMMISSIONER: As you move out into the sea, the sources of gravel along the coast or in proximity to the coast are those that you'll be most anxious to make use of, no question about that, I shouldn't think?

A We've made use of two sources of gravel, sir, and if we've been building an island in wintertime we've either hauled material from the shore land based sources or from some stockpile on previous islands. Summertime operations have basically been conducted with materials obtained from the sea floor itself.

Q And --

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1 A By far the largest amount
2 of material used in the islands has been obtained from
3 the sea floor.

4 Q Yes, I've seen the dredge
5 at work when I visited Immerk. Mr. Bayly is talking
6 about gravel and riprap to secure the banks of the
7 island, and that's the material that you have to
8 locate along the coast or close to the coast.

9 A Certainly ideally, yes.

10 MR. BAYLY: It's approximately
11 25 after 12, sir, and I'm about to start on another
12 topic, if you'd like to break at this time.

13 THE COMMISSIONER: Yes, all
14 right, we'll adjourn till two then.

15 (PROCEEDINGS ADJOURNED TO 2 P.M.)
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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

THE COMMISSIONER: The hearing will come to order.

MR. BAYLY: Mr. Commissioner I have here two telexes and they are in response to your request for the statistics for the years after '75-.75 at Coppermine. We haven't received an answer but I have attached that as an exhibit to the other documents I said I would put into the record. One being a letter from the Nortran training programme to Miss Noble of C.O.P.E. and one being a chart of the statistics I read into the record concerning Coppermine's social assistance over a period of years.

MR. HOLLINGWORTH: While we're on housekeeping duties, in response to Mr. Scott's request about the use of piles, I would advise that I have been instructed by the Foothills Engineering Department that the use of wooden piles is not anticipated for temporary work camps or compressor stations. At compressor stations, steel piling is presently contemplated where piling is required. Wooden piles would probably be used at wharf sites to hold the uni-floats in place. Such piles will also be used where necessary to support houses and other operations, maintenance buildings at the headquarters in Inuvik, Norman Wells, Fort Simpson and possibly Yellowknife, and with the use of compressor station heat, we have stated in our application that exhaust heat from small gas turbine generators would be used to heat compressor station buildings. Beyond that Foothills has not completed any specific investigation or other uses of

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1 waste heat and I have spoken to Mr. Marshall about this
2 and am advised by Foothills that they checked with CAGSL
3 and the University of Saskatchewan is conducting a study
4 of the use of turbine heat for greenhouses but this is
5 on-going and there is no final report.

6 THE COMMISSIONER: Thank you
7 Mr. Hollingworth.

8 MR. BALLEM: I believe that the
9 witness has a response to one of the questions that was
10 left unanswered this morning, namely about the estimate
11 of fuel consumed, and we might get that on the record
12 too.

13 THE COMMISSIONER: Fine.

14 WITNESS

15 MAINLAND: I might empha-
16 size that it is an estimate. It's about three hundred
17 and fifty thousand barrels over the project life of
18 the construction. I also had an estimate of the tonnage
19 that was being requested this morning and it looks like
20 about forty-one thousand tons for the plant.

21 MR. HOLLINGWORTH: Is that just
22 for the plant or is that also for the well-drilling equip-
23 ment?

24 (LETTER FROM NORTRAN TO NOBLE & 2 TELEXES MARKED
25 EXHIBIT 421)

26 ("GEOPRESSURE ZONES THAW CHALLENGE TO DRILLERS"
27 BY H. HEISE, DEC. 4/72 MARKED EXHIBIT 422)

28 A That's for the plant. About
29 thirteen thousand tons of that would go around the west
30 coast and about twenty-eight thousand down the Mackenzie.

Q

Did you get

1 any estimates for the other assets?

2 A I believe you will find the
3 other estimates in our application there for the drill-
4 ing.

5 MR. HOLLINGWORTH: Thank you.

6 MR. BAYLY: Does that complete
7 Mr. Hollingworth's questioning at this point?

8 MR. HOLLINGWORTH: Yes it does
9 thank you.

10
11 MR. BAYLY:

12 Q If we could turn to another
13 subject which is dealt with at page five of your evidence,
14 you have described the use there of sumps for the con-
15 tainment of certain materials and you have stated that
16 the dykes surrounding the sumps would be impervious, and
17 could you tell us what you would contemplate that these
18 would be constructed of to make them impervious?

19 WITNESS MAINLAND: We haven't
20 finally decided whether one would use a soil cement im-
21 pervious sheet material of some form. That type of
22 thing, but the design would be such that they would be
23 impervious to the fluid. This would be incorporated in-
24 side the gravel dyke.

25 Q When you talk about a
26 sheet, would that be made out of a plastic substance?

27 A It might well be. Yes.

28 Q Right. And, when you say
29 that that would be in the gravel portion of the dyke,
30 would it be covered with gravel and the fluids put into

1 it?

2 A It would be laid down and
3 then covered with gravel to protect it from any surface
4 damage.

5 Q Yes. Right. Now, is it
6 possible to construct at this point in gas processing
7 history, a liner which is completely impervious and that
8 will not tear or break or be subject to pin-holing?

9 A We believe that we should
10 be able to do that. Yes sir.

11 Q Now you've used an interest-
12 ing verb. You said you believe that you 'should' be able
13 to do this. Do I imply from that that you cannot do it
14 at this point?

15 A We have already installed
16 some liners for fuel containment, and so we are fairly
17 sure of the technology.

18 Q Have they been used as
19 liners for sumps, or are they restricted to the use that
20 you just mentioned?

21 A At this stage they have
22 been restricted to the use I have mentioned.

23 Q So although you are confident, it
24 would be fair to say that they have been not they have
25 not been tested for this use.

26 A That is correct.

27 Q And is there any fail-safe
28 or backup lining or dyking to the sumps contemplated to
29 ensure that if for some reason there should be a rent in
30 the lining that toxic materials or potentially toxic materials could not escape?

1 A We are intending to keep
2 these berms ^{frozen} in addition, so we really have a back-up in
3 that situation.

4 Q And I gather the reason
5 for your concerns, are the ones that you have expressed
6 at 3-141 of the thicker volume. That's found at the
7 bottom of the page where you stated, if I can sum it up:

8 "That a sump failure could release certain toxic
9 materials, including hydro-carbons and heavy metals
10 into aquatic environment."

11 That's 3-141, at the bottom under "Sump Failure".

12 A I'm sorry, I was looking
13 for the paragraph 3141, not the page.

14 Q Oh, I apologize.

15 A The reason, we wanted to
16 make the sump impervious and protected against possible
17 thaw erosion or over-topping is to ensure that we contain
18 the drilling mud materials.

19 Q Okay. Now, when you are
20 placing the lining into the sump, if you do decide to
21 use that method, you place it over a rough surface as I
22 understand it. It would be a soil surface or a gravel
23 surface. Would that be correct?

24 A A gravel surface. Yes.

25 Q So it wouldn't be perfectly
26 smooth?

27 A No.

28 Q And as I understand the
29 problems that do occur with this kind of lining, the
30 plastic over a period of time, because of the roughness

1 of the surface will create pockets that will lead to
2 small holes or rents in the lining, and this appears to
3 be something that has been a problem in the past.

4 A There are a variety of
5 different linings and there have been quite a few devel-
6 opments in the past few years in linings. Research has
7 been undertaken and I think that the heavier gauge films,
8 certainly, very light film is very prone to what you are
9 talking about, but I believe that the heavier films are
10 not susceptible, within reason, and I think that within
11 the design techniques that we can use to rupture due to
12 that kind of a problem.

13 Q Right. There may, I take
14 it be things that you can't plan for, that would cause
15 rents. If somebody drove a machine into the sump by mis-
16 take it might cause a rent.

17 A If somebody drove a mach-
18 ine in it might cause a rent, however, I have mentioned
19 we intend also to keep this embankment frozen so we do
20 have a back-up.

21 Q Yes. I understand that
22 there are ways of coating a sump wall, with salt waters
23 to create an impervious wall for the sump, and have you
24 investigated any of those possibilities?

25 A Sorry Mr. Bayly, did you
26 say with salt water?

27 Q Yes. They create soil
28 changes that --

29 A Yes, I mentioned we could
30 use one possibility would be soil cement, and that's

1 something that we'll look at. Asphalt lining is another
2 one.

3 Q Right. Now you haven't
4 investigated those at present to see whether they are
5 preferable to the plastic lining that we've been talking
6 about?

7 A We haven't made a final
8 decision. No sir.

9 Q Will you be testing out
10 these methods, before making that final decision and
11 testing them out in this area in the field?

12 A We have been installing
13 plastic linings at fuel tank farms in the Arctic for
14 several years now, and we are examining those regularly
15 to see how well they are standing up.

16 Q And how are they standing
17 up?

18 A Very good so far.

19 Q Have you had any problems
20 with leakages from them?

21 A We haven't experienced
22 leakage. We have had some problems with them which we
23 have been able to trace down to improper installation
24 technique and things like that.

25 Q I'd like to have you add-
26 ress your mind to the problems that severe storms can
27 create, and I suggest to you that one of the concerns
28 that you should have and have expressed some thoughts on
29 is that storms may cause a flooding of sumps, in certain
30 areas where the storms are bad enough and the walls of

1 any dyke are not sufficiently high. You appreciate that
2 as a problem?

3 A Yes, we appreciate that.
4 The height of our dykes will be designed with safety
5 factor to look after that problem.

6 Q All right. Now we've gone
7 over weather statistics with the pipeline applicants and
8 have found that with regard to storms, the history doesn't
9 go back a very long way with accurate details of the
10 height of storm surges. Where did you get your information
11 on this?

12 A Well, I think, a lot of
13 our survey work has been done in terms of driftwood, the
14 height of driftwood for instance in the neighbourhood.

15 Q That would take you back
16 at least as far back as the driftwood has lasted.

17 A I would assume that's
18 correct. Yes.

19 Q All right. Does ^{that} tell you
20 accurately the height in your opinion?

21 A My opinion would be that
22 it would give you a pretty good estimate, yes Sir.

23 Q All right. Now, I understand there are other problems that may be associated
24 with storms. Not necessarily related to the facility,
25 but related to bringing materials to the facility, and
26 have you contemplated the problem of supplying your site
27 from barges that are caught in storms and contingency
28 plans for the handling of toxic substances that will be
29 brought to the sites?
30

1 A You're suggesting that as
2 we're about to dock or something like that, that our
3 barges are caught in a storm.

4 Q Either that, or that you
5 will be bringing some materials in, crossing open water
6 bodies and may get caught in storms.

7 A Well, for instance, the
8 barges, I think are going to have to be adequate, adequ-
9 ately sea-worthy to stand up to wave action in storms.

10 Q I appreciate that sir, and
11 yet I invite you to agree with me that we are dealing
12 with a body of water that can be unpredictable and can
13 be very rough and that you must take into account the
14 possibility of accidents with ships and barges.

15 A By the time you get near
16 Taglu, I think you are sufficiently far inland that wave
17 height for instance is very considerably reduced.

18 Q Would you then be able to
19 tell us that you wouldn't be bringing anything in through
20 the Beaufort Sea from anywhere, either around--

21 A No, I couldn't tell you
22 that sir.

23 Q All right. So you may face
24 this, of bringing in substances that may be harmful if
25 they are allowed to escape, because of a shipwreck or a
26 barge accident?

27 A Yes. I'm sure if we had a
28 shipwreck, we might have some materials on board that we
29 would not otherwise intend to put into the ocean.

30 Q Have you given considera-

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1 tion to bringing materials that are toxic only in, by
4 travelling down river than through the open seas in this
3 area?

4 A I think ^{as} the practical
5 matter, most of the materials that you are talking about,
6 will indeed be coming by the river route.

7 Q What about bulk fuel?

8 A Bulk fuel would be coming
9 by barge, probably on the river route.

10 Q You wouldn't contemplate,
11 as Foothills suggested they might, bringing in tankers
12 through the Bering Strait.

13 A We have no such plans.

14 Q I know you have no such
15 plans. Would you rule that out entirely?

16 A I don't really think sir,
17 I could answer that without further thought but certainly
18 it hasn't occurred to us as a possible plan.

19 Q At page 2-24, you've re-
20 ferred in a list at 2.3.5.1.3 to drilling material. Now,
21 I see that one of the items that you have mentioned is
22 bentonite, which as I understand is a fine clay. Is that
23 correct?

24 A That's correct.

25 Q Now, when you're drawing
26 down a sump, if you're going to inject the liquids into
27 the ground, you will be left with certain solids which
28 have precipitated out. They will be sitting on the bottom
29 of the now dry sump. Is that correct?

30 A Yes sir.

1 Q And, would you agree with
2 me that one of these may well be the bentonite clay?

3 A Yes sir.

4 Q And, have ^{you had} your environmen-
5 talists examining the potential effect of this clay when
6 it dries on the surrounding plant communities?

7 A I'm not quite sure whether
8 I am clear. This is going to be contained in the sump.

9 Q That's right. Is there
10 any possibility that you can contemplate of its being
11 wind dispersed from the sump after the sump has been
12 drawn down? This may not happen until abandonment--

13 A I don't believe so. I
14 think we have also suggested that our plan on having
15 filled the sump and in essence completed active use of
16 the sump would be to cover it over which would effect-
17 ively mitigate against what you are suggesting.

18 Q You can appreciate the
19 problem then of this clay, ^{perhaps} drying out and blowing around.

20 A It might, although I sus-
21 pect that maybe some of the banks of the river there,
22 there might be as much material blowing around in terms
23 of fine silts.

24 Q Now, you've given us a
25 list here of drilling materials and could you tell us
26 whether that list is exhaustive of the drilling materials
27 that you would contemplate using at this facility?

28 A I would be foolish to say
29 it was exhaustive because I can't be absolutely sure
30 that what we are going to do in several years hence is

1 completely represented by this list, but this is a very
4 typical list of what we use in our present drilling op-
6 erations.

4 Q All right. Would you agree
5 with me that there are many chemicals and substances not
6 listed here that may well be used in drilling.

7 A May well be used in drill-
8 ing?

9 Q Yes.

10 A Anywhere?

11 Q Yes.

12 A Well, yes, certainly.

13 Q And what you've said is
14 that you can't tell me at this point which other mater-
15 ials you might use depending on the drilling conditions
16 that you run into.

17 A What you see in this list
18 is typical for drilling conditions in the delta and typ-
19 ical of the sort of mud programs that Imperial Oil uses.

20 Q Right. You included 100 tons
21 of miscellaneous, whatever that is.

22 A True.

23 Q All right. Miscellaneous
24 what?

25 A Well for instance, I'm not
26 sure that looking on this list that sawdust is on there.

27 Q And would it be contained
28 in the miscellaneous list?

29 A It is a possible use and
it would be contained in there, yes.

1 Q And it's very difficult as
2 you can imagine to guess at what else might be on the
3 list. Have you got a tentative list of what makes up a
4 hundred tons of miscellaneous?

5 A No I don't.

6 Q All right. How do you know
7 it's one hundred tons?

8 A I think that's a contin-
9 gency type of an answer. Possibly my drilling people
10 could give me a better breakdowns than that but--

11 MR. BAYLY:

12 I wonder, Mr. Commissioner
13 if we could request that the drilling people would give
14 a better breakdown so that we could see what is contem-
15 plated to come in?

16 MR. BALLEM: Certainly sir, we
17 will do the best we can.

18 MR. BAYLY: Could I
19 refer you to page 2-16. Now, under the paragraph
20 2.3.4.1 Geotechnical Conditions, you've described that
21 the Taglu plant is situated in the flood plain of the
22 Mackenzie Delta?

23 A Correct.

24 Q And you've gone to describe
25 the area as having old channels in it which have been
26 buried and modified by various floods.

27 A Right.

28 Q Are you satisfied, that
29 this plant that you're contemplating constructing will
30 not be damaged, or, perhaps even jeopardized by major
31 geomorphic changes during the twenty year projected life

1 of the project.

2 A Yes, we are satisfied
3 that, Mr. Bayly.

4 Q And what studies have you
5 got that indicates that this is a safe place?

6 A We have been looking at
7 aerial photographs to see what amount of bank erosion
8 takes place.

9 Q And, what sort of bank
10 erosion could we expect in twenty years, that would
11 affect the plan that you set out in figure three of your
12 evidence?

13 A We could expect about 20
14 feet of bank erosion and it wouldn't affect our plant.

15 Q If you had 20 feet of bank
16 erosion where your dock site is it might make it necess-
17 ary to re-build your dock, or to shore it up from time to
18 time.

19 A We might have to do some
20 remedial measures around the dock site. Yes sir.

21 Q And the same with your air
22 strip. It's possible from that that you might find that
23 the bank was slipping near the edge of your air strip.

24 A I think it's adequately
25 far from the bank to be quite safe.

26 Q Would you centerplate tak-
27 ing measures to secure the banks of the river in the area
28 of the dock, and perhaps, in the area near the airstrip
29 to avoid any problems with bank erosion?

30 A If it proved to be absol-

Q Have you looked at the possibility of ice-jamming causing flooding, either to your dock facility or your airstrip or any of the other facilities farther on-shore?

11 Q All right. You're not ele-
12 vating the sump, but you're building a wall around it.

14 Q But you would be elevating
15 the buildings on piles to look after the possibility of
16 flooding as well as thermal degradation.

18 Q I suppose for some periods
19 for some years you might send your men around to their
20 jobs in boats.

24 Q All right. Well then I take
25 it if you do contemplate that kind of flooding and
26 roadways being elevated, may still be subject to wash-outs
27 and the necessity for you to get additional gravel and
28 other granular materials to restore those from time to
29 time.

30 A We might need some small

1 amounts for maintenance purposes. Yes sir.

2 Q Well, have you contemplated
3 how much, on an average annual basis?

4 A No, I think it would be
5 very small.

6 Q Have you contemplated it
7 as a percentage of your total requirement?

8 A No, I haven't sir.

9 Q You're confident that it's
10 available?

11 A I think in the sort
12 of small quantities that we would be talking about it
13 should pose no problem. Yes sir.

14 Q Would you think of stock-
15 piling it on site, or would you just apply for it by way
16 of a land-use permit as you required it?

17 A I suspect that the first
18 year or two of experience would tell us which would be
19 the optimum way to go there. I couldn't say at this time.

20 Q Would you say then, that
21 you wouldn't be stock-piling it to begin with?

22 A I don't believe so.

23 Q Let's turn our attention
24 now to the possibility of well blowouts. Now, my inform-
25 ation is that there are five possible causes of blowouts
26 and invite you to either agree or disagree with these as
27 I go through them. The first one being insufficient mud
28 weight. Would you agree or disagree with that one?

29 A Well that's a sort of a --

1 these are rather broad type statements in whether in-
2 sufficient mud weight per se is the cause of a blow out.

3 Q Let me give you the five
4 of them and ask you to comment on them either in combin-
5 ation or singly, as you see fit.

6 The second one is not keeping the hole full; the
7 third one is lost circulation; the fourth one
8 which I was not able to find out the meaning for is
9 swabbing on trips; and the fifth one is charged formation.
10 And would you care to comment on how those five factors
11 may either cause or contribute to the cause of a blow-
12 out?

13 A I think they all say that
14 if you don't go about your business properly, you maybe
15 able to find yourself in trouble but, I don't think any
16 of those are ones that for instance in drilling in Taglu
17 we should experience.

18 Q So these are factors of
19 possible human error.

20 A Basically. I am not sure
21 that charged formations is.

22 Q Well perhaps not diagnos-
23 ing formations as charged maybe the error.

24 A Right.

25 Q Can you tell us what
26 swabbing on trips is?

27 A Well that would be if you
28 were pulling out of the hole and in the process in effect
29 lightening the column.

30 Q I understand. Now you're

1 not suggesting of course, that human error is something
2 that you've solved.

3 A No, I'm not, sir.

4 THE COMMISSIONER: They're
5 working on it. They expect to make an announcement soon.

6 (LAUGHTER)

7 MR. BAYLY: I haven't seen the
8 report.

9 WITNESS MAINLAND: We worked
10 very hard on that one.

11 Q That is a problem though
12 that you have to deal with. You've got to give your men
13 proper instruction.

14 A Certainly.

15 Q And make sure that they
16 are on the watch all the time for these kinds of errors
17 that they could make.

18 A Absolutely.

19 Q And blow outs do occur in
20 gas fields.

21 A They have happened.

22 Q Now can you describe--

23 THE COMMISSIONER: Excuse me.
24 Before you leave that subject, Mr. Mainland, when you're
25 conducting, it seems to me there are, you might tell me
26 if I'm wrong about this but when you are conducting an
27 exploratory drilling program and all that you have got
28 to go on is seismic --the results of seismic tests and
29 so forth, that's the kind of drilling where you may not
30 be certain at what depths, or even if you will encounter

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1 hydro-carbons, but as I understood it there is another
2 kind of drilling involved here and that is when you
3 are establishing these clusters of wells, you may be
4 drilling but with presumably from one you've established
5 the pad, you are drilling wells there and having very
6 good information about where, what depths and under what
7 pressures you are going to encounter gas. Now, are blow-
8 outs likely to occur in the--not likely but whatever
9 possibility there may be of blow outs occur is it
10 greater in the second instance, greater in the first in-
11 stance than in the second or --

12 WITNESS MAINLAND: Oh I think,
13 you know,
14 /we would have to say, Mr. Commissioner, that when you're
15 drilling into the unknown obviously more care has to be
16 taken and possibility there is more room for human error
17 than in a development well drilling situation where the
18 formations and pressures are well known.

19 MR. BAYLY: Now, are you acquaint-
20 ed with the problems associated with drilling into
21 what are called geo-pressure zones?

22 A Yes, Mr. Bayly, I'm acquaint-
23 ed with them.

24 Q Am I correct in stating
25 that these are intervals with abnormally high formation
26 pressures?

27 A That's correct.

28 Q Now, I have a portion of an
29 article from "Oil Week" for the 4th of December, 1972 which
30 talks about geopressure zones in relation to blow outs
and I'll read two paragraphs from that and invite you to

1 comment on it, if you would. The article is called Geo-
2 pressure Zones Throw Challenge to Drillers in Three
3 Canadian Plays by ^{Hurst} Heise, who is their exploration ed-
4 itor, and I'll submit this as an exhibit sir, when I've
5 read these paragraphs. On page forty-four,

6 "Geopressure zones fortunately do not come in with
7 a bang. Instead a gradual build-up of pressure is a
8 rule. The transitional zone leads to the super pressure
9 zone, sorry, the transitional zone leading to the super
10 pressured zone can be thousands of feet thick or may
11 measure only a few hundred feet. A tight cap rock, con-
12 sisting of for instance limey shale, might lead to a rel-
13 atively fast change of formation fluid pressures. Changes
14 of nearly five thousand p.s.i. over intervals of only a
15 few hundred feet have been recorded. This is why it is
16 so important not to stumble over the first indication of
17 geopressure conditions below. It could very quickly be-
18 come a serious problem. What is obviously needed is exper-
19 ience, but not only with the problem as such, rather al-
20 so with local conditions, and local conditions could
21 mean several areas within the same general environment
22 each of which displays distinctly different pressure
23 patterns at depth.

24 In the Mackenzie Delta, for in-
25 stance, north of a roughly east north-east trending
26 major fault zone, tough geopressure zones must be ex-
27 pected. On the seaward or northward side of the fault
28 a major downward movement of sediments has occurred, and
29 the corresponding sedimentary section, i.e. the section
30 that is younger than the initial fault movement, is

1 accordingly very much thicker than landward from
2 this line. All of Imperial's finds and most of the
3 well drilled, drilling^{or} planned in the delta re-
4 gion lie on the high pressure side of this major
5 feature."

6 Q Do you agree with that sir?

7 WITNESS MAINLAND: I'm not sure
8 that my knowledge is that extensive but we certainly fre-
9 quently drill into what might be called over-pressure
10 zones. Yes.

11 THE COMMISSIONER: Well, Mr.
12 Stewart you're a reservoir engineer. Does this statement
13 ---

14 WITNESS STEWART: Well sir, my
15 detailed knowledge doesn't apply much to the drilling
16 operations or the formations found on the way to the
17 field.

18 THE COMMISSIONER: O.K. You
19 tell us it's there, not how to get it out.

20 WITNESS STEWART: How to get it
21 out of the reservoir, we found, but not how to get the well
22 down to that reservoir, sir.

23 MR. BAYLY: Mr. Commissioner,
24 I am hoping that we can get some comment from Imperial
25 on this matter. Perhaps these witnesses could seek ad-
26 vice from somebody in there company as to the nature of
27 this problem and whether it is well in hand or whether
28 it is the current concern/^{that is} expressed in this article.

29 WITNESS MAINLAND: Mr. Bayly, I
30 can comment on that situation with respect to the problem,

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1 I couldn't comment on whether all our acreage or every
2 prospect was similarly situated but we recognize the
3 possibilities of overpressures. It's a problem, if we
4 want to call it that, which has been recognized in the
5 Gulf coast, Gulf of Mexico, for many years. There are
6 techniques to handle the situation. It requires caution,
7 it requires diligent observation on the part of the peo-
8 ple drilling, but it is not an insuperable problem or an
9 unwarranted danger.

10 MR. BAYLY: All right. What
11 you are telling me is that people are already drilling
12 in these kinds of zones in other parts of the world.

13 A Have been for many years.

14 Q That doesn't mean that they
15 are not somewhat of a concern?

16 A They require more care.
17 Yes sir.

18 Q And would you say, that if
19 you compared them with low pressure gas deposits that
20 they present problems that are not presented in low pre-
21 ssure gas fields?

22 A I'm not sure whether one
23 can really balance out low pressure gases against over-
24 pressured formations but, there is no question but that
25 you have to be careful in drilling wells in over-pressured
26 zones.

27 Q And blow-outs have happened
28 in the world. It's not something that I am raising as a
29 complete impossibility in the Mackenzie delta.

30 A I wouldn't say that it's a

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1 complete impossibility, I couldn't be sure how often
2 blow-outs have been associated with over-pressured zones.
3 I think that may tend to be rather small.

4 Q Right. Now you've told us

5 THE COMMISSIONER: Excuse me.

6 Can you have blow-outs in the zones that do not have ab-
7 normally high pressures then?

8 WITNESS MAINLAND: The most
9 blow-outs will occur as has been brought out I think, by
10 some human error and it doesn't have to be an over-
11 pressured zone to do that.

12 MR. BAYLY: Now you've told us
13 that the gas that has presently been found by Imperial,
14 and which is the concern of this particular application,
15 is sweet gas.

16 A That's correct.

17 Q And, that where we would
18 be most concerned, with a blow-out, is in a field which
19 contains sour gas. Gas particularly containing hydrogen
20 sulphide.

21 A Obviously, that's more of
22 a hazard than with sweet gas.

23 Q Now, although you have
24 said that you have found sweet gas, do you agree with me
25 that it is possible that in the acreages held by Imperial
26 that it is possible and perhaps even likely that you will
27 find some gas that is not entirely free of hydrogen sul-
28 phide?

29 A I would agree that it's
30 possible in my opinion, and the best advice I can get is

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1 that it is unlikely.

2 Q Right. And it is possible
3 as I understand for a sweet supply of gas to go sour?

4 THE COMMISSIONER: To what?

5 MR. BAYLY: To go sour.

6 THE COMMISSIONER: To go sour,
7 in the reservoir?

8 WITNESS MAINLAND: I haven't
9 personally known of a gas field going sour. I can rec-
10 ognize that some oil fields when water flooded, with sur-
11 face waters containing sulphate reducing bacteria, have
12 had a tendency to go sour. Yes.

13 MR. BAYLY:

14 Q And you contemplate the
15 possibility in this area of finding not just gas, but oil
16 in conjunction with gas. That's not an uncommon thing to
17 find.

18 A There might be small amounts
19 I think; one critical factor in terms of this possibility
20 of going sour is the sulphate content of the reservoir
21 brine, which in this area is very low.

22 Q And that is, when you say
23 in this area it's very low, in what you found in this
24 area is very low.

25 A Well, obviously that's
26 correct. Yes.

27 Q Right. And if you go as
28 far west as Prudhoe Bay you find a different situation?

29 A I couldn't respond to that.

30 THE COMMISSIONER: Well what--
are you saying at Prudhoe Bay you find vast quantities of

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1 oil associated with gas. Is that the point?

2 MR. BAYLY: No, but you find
3 gas that is not sweet, in the jargon as the gas has been
4 described.

5 MR. COMMISSIONER: I see, I
6 thought that you said oil there, it threw me off. All
7 right.

8 MR. BAYLY: I'm sorry. I was
9 speaking of both at the same time Mr. Commissioner, one
10 right after the other and I think the confusion was my
11 fault.

12 Q Now, material, that you
13 have put before us at 2-26, refers to the "Interim Guide-
14 lines For the Disposal of Waste Fluids From Petroleum
15 Exploratory Drilling in the Canadian North." Do you have
16 that report in the possession of your company?

17 A I think, Mr. Bayly, we
18 have what may be getting to be a final draft. I don't
19 believe that the final report has yet been issued. This
20 is work being done in conjunction with the Department of
21 the Environment and the Department of Indian Affairs,
22 Northern Development, together with several companies,
23 and my understanding is that it has not yet finally been
24 issued.

25 MR. BAYLY: Mr. Commissioner,
26 perhaps I could request that that report be produced,
27 even in the form that it's in, if that's possible, by a
28 combination of the Producers and the Government. I
29 think it's one that may be very important to us.

30 MR. BALLEM: How to respond to

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1 that one Mr. Commissioner. We are anxious to co-operate
2 in every way we can however, it does occur to me that
3 this is not a finalized report and that there are two
4 Government Departments. It may be more appropriate to
5 get the finalized report from those Government Depart-
6 ments. I really don't know how to respond to this. We
7 would like to help, but I'm a little bit concerned about
8 preliminary reports floating around.

9 MR. BAYLY: With my luck with
10 Mr. Scott, I thought I had better bring Mr. Ballem in on
11 it, Mr. Commissioner.

12 MR. SCOTT: Well, I'll make in-
13 quiries about it Mr. Commissioner if Mr.--

14 THE COMMISSIONER: It hasn't
15 been submitted to the government yet as I understand it.
16 It hasn't even been written in the form in which it is
17 to be submitted, has it?

18 WITNESS MAINLAND: No, it's in
19 a, I think it's in a about a final draft stage and the
20 Government people are as active in this as we are.

21 THE COMMISSIONER: Oh, I see.

22 MR. SCOTT: As I understand it,
23 it is a kind of a joint effort. If Mr. Ballem can ex-
24 press for his client that he has no objection to it,
25 that will get one of the proponents out of the way and
26 then I will try and deal with the other.

27 MR. BALLEM: All right, we will
28 say that we have no objection to it.

29 MR. BAYLY: Thank you sir.

30 Q Just a short ques-

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1 tion with regard to your evidence on page 11. You said
2 at the top of the page that both wood and steel piles
3 will be used depending on the design requirements. Could
4 you tell us whether it would be possible to build using
5 steel piles only?

6 A Yes it would.

7 Q All right. And you've
8 heard our concern with regard to pilings taken from the
9 delta?

10 A We have, I guess, contra-
11 dictory concerns expressed to us between, providing em-
12 ployment for native peoples in the Northwest Territories,
13 and denuding the forests.

14 Q. Right. One of the things
15 that I brought up in cross-examination of the pipeline
16 applicants', is the possibility that when they are clear-
17 ing the right-of-way, farther south, that they will be
18 cutting down a large number of trees that might be suit-
19 able for pilings, some of which they say is merchantable
20 timber will be made available to people who want it.
21 Have you explored with them, the possibility that this
22 might be the source of your pilings if the trees were to
23 be cut down anyway.

24 A No, I haven't.

25 Q Would that be something
26 that you would be intending to do? They said that they
27 intended to discuss it with you.

28 A In that case I guess we
29 will be.
30

1 Q Sort of like taking you
2 both to lunch.

3 MR. HOLLINGWORTH: I might as
4 well add my two cents worth at this point Mr. Commissioner
5 in my previous announcement about pilings, I neglected to
6 mention that our discussions on this have been with the
7 Government of the Northwest Territories, which has a
8 scheme to institute a mill at Fort Simpson and produce
9 pilings from that, using a large extent of the native
10 labour if possible.

11 MR. BAYLY: Just to follow up a
12 point I brought up earlier with regard to drilling mat-
13 erials, compounds and substances you may use. Have you
14 given a list to your environmentalists of the possible
15 chemicals that you might use to get their recommendations
16 of ones that they would either recommend your using or
17 not using.

18 WITNESS MAINLAND: I think, no
19 we haven't, I don't believe to our, to Mr. Slaney for
20 instance. Those interim guidelines you referred to a few
21 moments ago, examine the toxicity of various compounds
22 and in effect provide guidance ^{as to} what should or should not
23 be used.

24 Q And I take it that there
25 are alternatives, that in some instances you can use one
26 compound rather than another.

27 A In many cases there are.
28 I think there may be some things, you know, you can't
29 back out bentonite very easily and so on.

30 Q And I take it that

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1 you would be prepared, your company would be prepared to
2 use alternates which were acceptable but which had less
3 potential danger to the environment.

4 A We already have taken steps
5 like that. Yes sir.

6 MR. BAYLY: Thank you gentlemen.
7 Those are all the questions I have.

8 MR. BELL: I have no questions
9 for the panel.

10 MR. BAYLY: Mr. Commissioner,
11 before Mr. Scott begins I'll give this report to Miss
12 Hutchinson to be marked as an exhibit and I have here
13 copies of that letter I referred to this morning and I'll
14 have one put in as an exhibit and distribute the rest.

15 THE COMMISSIONER: Fine.

16 MR. BALLEM: I wanted to ask
17 Mr. Bayly, what report he is referring to.

18 MR. BAYLY: Report ^{from} is the wrong
19 word Mr. Ballem, it was the article that I read out of
20 "Oil Week".

21 MR. BALLEM: I guess I am very
22 conscious of the fact that I am a new-comer here,
23 so I guess this is for my own information, but, is that
24 the article by Mr. Heise.

25 MR. BAYLY: Yes that's the art-
26 icle I referred to, and I don't put it in as intending
27 to rely on it but in case I've quoted it out of context
28 that will give the participants the opportunity to look
29 at it.

30 MR. BALLEM: Thank you.

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1 THE COMMISSIONER: I don't think
2 that we'll regard an article in "Oil Week" four years
3 ago as decisive.

4 MR. BAYLY: The other thing I
5 have Mr. Commissioner is page thirteen of Mr. Shaw's ev-
6 idence which didn't get in between pages twelve and four-
7 teen.

8 MR. MARSHALL: That destroyed
9 the whole plot.

10 MR. SCOTT: We remind you, Mr.
11 Commissioner we have relied on an article from the Vic-
12 toria Colonist describing the collapse of a buried
13 pipeline in Northern China, so, I don't know that we chilled
14 should exclude "Oil Week".

15 (LAUGHTER)

16 THE COMMISSIONER: Well, the
17 incident referred to in the Colonist was unidentified,
18 according to place and date. I think that's why you re-
19 lied on it.

20 MR. SCOTT: And it was, after
21 all the Colonist.

22 (LAUGHTER)

23
24 CROSS EXAMINATION BY MR. SCOTT:

25 Q Gentlemen, the physical
26 setting of
27 /your Taglu development is comparable in many respects to
28 terrain which is found on the route in which the trunk
29 pipeline will be located and particularly the cross-
30 delta portion of that pipeline will be located, and con-
31 sequently, I'd like to ask you some questions which may

1 help to shed light on issues or problems that may con-
2 front those who have to build the pipeline.

3 First of all, what maximum
4 flood level have you designed for in planning wharves,
5 gravel pads, elevated flow-lanes, swamps, sewage facil-
6 ities? I think you said eight feet at one point and the
7 thing that troubled me was eight feet from what.

8 WITNESS MAINLAND: I think, sorry
9 can you hear me? I think, what I was referring to there
10 was the berm would be eight feet, and of course we are
11 already somewhat above the water. As I can quickly gath-
12 er here from a draft I have, it's about six feet or so
13 of flood over the low-lying parts of the land there.

14 Q Well--

15 A My difficulty is,
16 that the data I have refers to a bench mark on a well
17 head and I'm trying to work from that. Maybe instead of
18 taking time here we could provide you with that answer
19 later Mr. Scott.

20 Q Well that would be satis-
21 factory. I take it, just so the picture will be clear
22 in my mind, that in a flood or a storm, unless precau-
23 tions are taken, by way of dyking or what have you, the
24 whole terrain on which your plant will be located, may
25 be well under water?

26 A Certainly the land on
27 which we are proposing to build the plant, at times is
28 under water. Yes sir.

29 Q Now, in planning your fac-
30 ilities, is erosion by flood waters a problem that will
require riprap around the gravel pads?

1 A We don't believe so, we
2 believe that the design of the pads will be adequate to
3 look after that.

4 Q I take it that the funda-
5 mental sort of design determination you've made is, has
6 been to build or develop dykes around the area that you
7 require to utilize in that way to keep it dry, rather
8 than to do what a novice like myself would have done which
9 is simply to bring in a lot of gravel and build up the
10 level.

11 A We are doing a little bit
12 of both, I believe it would be fair to say, in that the
13 roads are built up and other areas are dyked.

14 Q But I take it that
15 apart from the roads, the fundamental decision has been
16 to dyke rather than to raise the level of the land on
17 which the complex is to be constructed.

18 A I would say that's correct.
19 Where we can we would prefer to use dykes.

20 Q And, would it be fair to
21 say that the fundamental reason why you've made that de-
22 termination is cost?

23 A It's obviously a combina-
24 tion of cost and simply to minimize the use of granular
25 materials.

26 Q Depending on the vantage
27 point one looks from, cost and granular materials do tend
28 to become the same thing.

29 A True, I don't think there
30 is anyway that any of us in the delta can dissociate our-

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Cross-Exam by Scott

from the fact
1 selves that we should not be wasting granular materials.

Q What are the first
3 point form, if you can, what are the trade-offs that
4 come into play when you make a decision to generally go
5 one way rather than the other? Now, we've dealt with
6 the question of cost and economies as far as granular
7 materials are concerned, what are the other?

A I think volumes of granu-
9 lar materials are the major consideration.

Q Are there any other trade-
11 offs that are involved in the equation that leads to that
12 decision, apart from what you've now told us?

A That's the fundamental
14 reason for our design.

Q Well, I take it that you
16 must have to calculate the possibilities and the conse-
17 quences of breaching a dyke, and put that into the equa-
18 tion as well.

A Well, in normal engineering
20 fashion, I guess, we've estimated storm height, we've
21 estimated wave height during a storm, in that location,
22 and then allowed for a safety factor above that. Now,
23 if you're saying, what would happen were we to overtop,
24 I'm not ^{really} sure there would be very serious if you did over-
25 top, obviously you don't want to wash the entire sump
26 out and we intend a design so that that couldn't happen.
27 Some material being washed away with the amount of water
28 around at the time, probably would not be a serious en-
29 vironmental hazard, but I would leave that to the enviro-
30 nmental panel to discuss.

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1 Q Well now, on page eleven of
2 your transcript, I don't think it's necessary to dig it
3 out, but on that page you comment on ponding of flood
4 waters around your installations and construction of
5 culverts to limit this, do you anticipate any permafrost
6 degradation resulting from that kind of ponding, which
7 would lead to the slumping of dykes or pools?

8 A No, we don't Mr. Scott.

9 Q In designing your facilities
10 ties in areas there must be here, in ice rich areas, we
11 note that the foundations, it has been indicated that
12 the foundations are designed to take care of the consequences
13 of ice rich fine grain permafrost type soil.
14 Imperial, I gather has had some experience, that not all
15 others have had in structuring on such soils, and I wondered
16 if you could, just outline in point form from Imperial's
17 experience the principle problems that you think
18 have to be guarded against, in that kind of construction.

19 A Essentially, we are protecting
20 the permafrost from degradation, as you mention,
21 in order to aid us in adequately designing these facilities
22 we have studied the permafrost in the Taglu area
23 for a number of years, to enable us to adequately check
24 out mathematical simulation of heat flow in and out of
25 the permafrost and allow us to design the correct amount
26 of gravel or other insulation which we would place on
27 top of the ice rich soils to maintain the freeze profile
28 up into the gravel.

29 Q So I take it that one of
30 the things you contemplate is that the permafrost would

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1 rise up into the gravel pads.

2 A It certainly, our inten-
3 tion is that it shouldn't drop below, you know, where it
4 is now. Otherwise we'll of course get thermokarst and
5 subsidence. The design is quite definitely intended to
6 prevent that from occurring. There might be small amounts
7 at the toe of a berm and the design of the toe of the
8 berm tapering out is intended to try to minimize that.

9 Q But, did you contemplate
10 one of the things that might occur in construction, that
11 the permafrost would rise up into the areas that you
12 had padded with gravel?

13 A Into the gravel?

14 Q Yes.

15 A The frozen thirty-two de-
16 gree Fahrenheit, if you like, isotherm might be into the
17 gravel. Yes.

18 Q What I'm merely asking is,
19 was that a consideration that was at play when you came
20 to make your judgement?

21 A I think the consideration
22 is to make sure that we don't thaw the permafrost. If
23 we can bring the freeze profile into the gravel, so much
24 the better, but we may be overdoing the insulation if
25 we try and bring it up too far. There is no need to.

26 Q It then becomes a quantity
27 of gravel question.

28 A Gravel, or other insulation.
29 Yes.

30 Q Now, were there any par-

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Cross-Exam by Scott

1 ticular localized engineering problems that you had to
2 consider, where for example, the permafrost was very
3 thin, or where you encountered boundaries between frozen
4 and unfrozen soils, as on a bank where you were going to
5 construct dock facilities or something of that type?

6 A No, I think we pointed out
7 that we still had some boring to do around the docks to
8 be sure of our design there, but otherwise, I don't think
9 we found any serious heterogeneses in the permafrost
10 that would give us problems.

11 Q You didn't then, run into
12 any thin areas, as far as you now know?

13 A Not that I'm aware of, Mr.
14 Scott.

15 Q And, do I understand you
16 to say with, that with respect to any problems associated
17 by the contact of the interface, to use my new
18 word for the month, between frozen and unfrozen soils
19 that you really haven't done sufficient drilling to de-
20 termine whether that's a problem you are going to have
21 to confront.

22 A I can't really see that
23 it's going to create a problem for us, no. Using silts
24 we might have to worry, but with gravel we don't.

25 Q You don't foresee any prob-
26 lem for example, at dock facilities? I ask these ques-
27 tions, not because I am concerned at all about whether
28 Imperial's project is going to withstand the storms and
29 the sleet and the cold of the North, because we are not
30 really concerned about that, but simply to give us some

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1 assistance in gauging the applicant's response to like
2 problems.

3 A We're certainly concerned
4 about that and we don't believe that we are going to en-
5 counter any severe problems, Mr. Scott.

6 Q No, but do you see any
7 problems associated with the construction of docks, which
8 are obviously at the water line. Any permafrost prob-
9 lems?

10 A It's going to depend, I
11 believe, a lot on the material in the vicinity of the dock.
12 The ice content, the active layer, a variety of consid-
13 erations such as that, but, I guess my impression is,
14 that we can certainly adequately design a dock to operate
15 satisfactorily in that kind of a situation. We have op-
16 erated a dock at Bar C for a number of years, and while
17 we have to conduct some repairs, it isn't any serious
18 problem for us.

19 Q Well now let's come to
20 river channels, which are of a concern obviously not
21 only to Imperial but to trunk pipeline companies that
22 have to build in this kind of terrain. What information
23 do you have regarding the rate and processes of bank
24 erosion?

25 A As I have mentioned, we
26 have been looking at aerial photographs over a number of
27 years to try to determine the amount of bank erosion. I
28 don't believe that we have any other information at this
29 time.

30 Q At one point in your evi-

1 I think
2 dence, you referred to twenty feet in twenty years at a
3 particular location.

4 A Yes. The best estimate we
5 can have of erosion on the bank near our plant site, is
6 about a foot a year. Hence the twenty feet.

7 Q I see. And was that based
8 on your examination of aerial photographs in the area?

9 A That's correct. Yes.

10 Q And as far as you now rec-
11 ollect you have no other material or data, apart from
12 that upon which you relied in making that kind of an
13 assessment.

14 A No, I suppose that our
15 normal, visual observations at sites like Bar C which
16 has been there for a number of years now, have given us
17 some confidence in the stability.

18 Q Well, what use if any can
19 we make of that one foot a year figure? In Imperial's
20 judgement is that standard for the kind of terrain, in
21 which you are engaged in the delta, or is it particularly
22 typical or untypical?

23 A I really am not competent
24 to advise you on that Mr. Scott.

25 Q Now what information do
26 you have, if any, on scour patterns and depths in delta
27 channels?

28 A I was going to say, that
29 I'm aware that some work is being done but that's about
30 the best response I could give you at the moment. One
of the advantages of our Taglu site, is that we don't

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1 have a major river crossing.

2 Q With Mr. Ballem's consent
3 I would appreciate if you could make available, in the
4 format that is convenient to you, whatever information
5 you have about that matter.

6 MR. BALLEM: Which matter is
7 that?

8 MR. SCOTT: Scour patterns in
9 depth in the delta channels.

10 WITNESS MAINLAND: I think I
11 said I was aware that there has been some work done.
12 But I'm not sure that I could identify a report or a
13 piece of paper with anything written on it, you know.
14 In discussions with people about the areas, one
15 hears talk about scour in parts of the river and things
16 like that. That's not a very well identified source of
17 information.

18 MR. BALLEM: I wonder Mr. Scott,
19 it might be **helpful** if you ask those question to the en+
20 vironmental panel. I'm not sure but I think they might
21 be more able to assist us.

22 THE COMMISSIONER: Your point
23 is that isn't something that you would have considered
24 because you have no river crossings that stand between
25 your wells and the Taglu plant.

26 A That's correct Mr. Commiss-
27 ioner.

28 MR. SCOTT: Mr. Commissioner,
29 I asked these gentlemen, because I think they are proba-
30 bly the only engineers I am going to get at and it may

1 be that the environmentalists will not be able to direct
2 themselves to that. I will however, ask the environ-
3 mentalists about it, and really what I seek is, apart
4 from word-of-mouth sources in which I'm not interested,
5 if there is any work that has been ^{done} for Imperial and
6 which is in written form about scour depth and scour
7 patterns in the delta, I would appreciate it if Imperial
8 could consider making that available, because as you will
9 see that question bears very directly on how a trunk
10 pipeline can be constructed across comparable terrain.
11 So, perhaps----

12 MR. BALLEM: MR. Scott, we don't
13 believe we have any but if we have any we will make it
14 available.

15 MR. SCOTT: I guess that's batt-
16 ing five hundred for me so -----

17 THE COMMISSIONER: On the en-
18 vironmental panel, Mr. Appleton and Mr. Wopnford, are
19 both engineers. You're batting five hundred there too.
20 There's four people there--

21 MR. SCOTT: I'm batting three
22 hundred and thirty.

23 Now what about information about
24 the movement of sediments in channels? Do you know
25 whether Imperial has any information on that subject re-
26 lated to delta channels?

27 A I don't believe so Mr.
28 Scott.

29 Q All right. Have you any
30 information, as far as you know, on channel dredging in

1 the delta?

2 A I'm not quite sure what
3 you would refer to by information on channel dredging.

4 Q Information about the con-
5 sequences, in terms of the channel, of dredging. The
6 channel and the banks and the movement of sediment and
7 so on.

8 A I think our environmental
9 people might be able to give you some comments on that.

10 Q All right. In your pre-
11 pared evidence on pages 12 and 13 and also in the big
12 volume at pages 2-53 and 54, you refer, and Mr. Bayly
13 has discussed with you I think, the possibility of ex-
14 cavating sand from the river channel adjacent to the Big
15 Horn Point. Now, you refer there to environmental and
16 construction studies which are underway, to determine
17 the feasibility of that. Could you tell us the concerns
18 to which those studies are directed?

19 A Well basically, in as far
20 as environmental is concerned, as to whether it would be
21 possible to obtain that sand for our purposes without un-
22 due environmental impact. Technically, whether the mat-
23 erial will provide a suitable base, construction-wise is
24 basically how we would extract it, possibly up-grade it
25 a little, convey it and place it.

26 Q Does this involve, the
27 rate at which the sediments in the channel will move, or
28 the distances over which they will move?

29 A No, it doesn't, I don't
30 believe.

1 Q I presume that it does in-
2 volve considerations of river bank erosion and that sort
3 of thing. Does it?

4 A Obviously, that would have
5 to be a consideration if we were going to mine or extract
6 close to the river bank.

7 Q When do you anticipate,
8 life being what it is, these reports will be ready?

9 A Well, life being what it is,
10 I would suggest sometime within the next six months.

11 Q Mr. Ballem when those are
12 available could you give consideration to making them
13 available to the Inquiry.

14 MR. BALLEM: When they are
15 ready we will make them available.

16 MR. SCOTT: What are the con-
17 siderations involved in determining whether this will be
18 used as a granular source. Are there considerations other
19 than environmental considerations at stake?

20 A There are certainly tech-
21 nical ones at stake. For instance too high a degree of
22 fines in the sand could make it an unsuitable material.

23 Q And there are cost consid-
24 erations as well?

25 A Yes, there will be cost
26 consideration.

27 Q I'd like to just ask one
28 or two questions about gravel sources, and this concerns
29 me for the reasons that Mr. Bayly has emphasized. We
30 hope Imperial gets all the gravel it wants, but there are other people and there will

1 be other people in the next generation who require gravel
2 as well and we all begin, as I understand you with the
3 proposition that good quality gravel in the delta is not
4 in overly abundant supply, to choose the most neutral
5 words I can. Isn't that true?

6 A I don't think one can give
7 an unqualified response to that. I understand for in-
8 stance that there is probably a good deal of possibly
9 good gravel material in Caribou Hills.

10 Q Well, let's just look then
11 and see if I understand what we know about the situation
12 near your project. Your study, the study that you refer
13 to, has told us something about the volumes that are
14 present at Yaya, 9.5 or something like that.

15 A That's a top of the head
16 number in terms of --

17 Q All right. Then there is
18 a general statement in your evidence which is contained
19 at page 2-7 that gravel deposits at Yaya Lake are ade-
20 quate for all proposed on-shore gas development pro-
21 grams. I read that and my first instinct is to say, well
22 hurrah, that problem's solved, we don't have to worry
23 about it. Then one looks at it again and I wonder how
24 you know that. What you know that enables you to con-
25 clude with assurance that those supplies are adequate.

26 A Well, I think it does say,
27 "for all proposed."

28 Q All right. Is there a
29 hooker in the word proposed? Does that mean that three
30 oil producers, or gas producers?

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1 A Mr. Scott, I'm not quite
2 sure what you mean by hooker.

3 Q I'm sorry, that's an un-
4 fair --

5 A It's written, at the time, --
6 you know when this was written the proposed projects
7 didn't require more gravel than was there.

8 Q Well, let me ask you this
9 then. When you say in the statement, that gravel depos-
10 its are adequate, that isn't enough. You have to quali-
11 fy that by saying, "that it is adequate to all proposed
12 on-shore gas development programs" at the time the docu-
13 ment was written. That's what it means, doesn't it?

14 A Yes, that's correct.

15 Q All right. Now what is
16 "the proposed on-shore gas developments" at that time?

17 THE COMMISSIONER: What page
18 is that at?

19 MR. SCOTT: 2-7.

20 Q Let's go through them.
21 The three producers would be included.

22 A That's correct.

23 Q So there is enough for
24 them.

25 A Yes.

26 Q How about Arctic Gas?

27 A I'm trying to recall whether
28 we were including Arctic Gas in that statement at that
29 time. I believe so.

30 Q Well, let me put it to you

1 this way. That if, assuming, you were including Arctic
2 Gas, you couldn't have been considering Arctic Gas's
3 cross delta prime route. Because no one was considering
4 that until very recently.

5 MR. BALLEM: This report is
6 dated December, 1975, or am I looking at the wrong one.

7 MR. SCOTT: That's right, yes.

8 MR. BALLEM: I've been hearing
9 about the cross delta for several months now.

10 MR. SCOTT: Well, maybe these
11 things come to us later than to others.

12 MR. BALLEM: Like last March.

13 MR. SCOTT: Well, let me ask
14 the witness. Were you considering Arctic Gas's cross
15 delta proposal, when you made that statement?

16 A I believe the possibility
17 of Arctic Gas wishing to use a cross delta route was
18 considered. Yes.

19 Q I take it that that was
20 the limit of proposed on-shore gas developments.

21 A Yes, it was.

22 Q All right. Well, are you
23 or are your studies able to tell us anything about the
24 extent to which those proposed on-shore gas developments
25 will utilize what is available at Yaya?

26 A Well, you know the discuss-
27 ion we have been having on Big Horn Point, indicates
28 that I can't give you a positive answer to that question
29 I believe.

30 Q Well, presumably , when

1 you made this statement, what you did was you had 9.5
2 in one margin and then you added up the estimated re-
3 quirements for the other proposed developments. Would
4 that be fair?

5 A Obviously we must have gone
6 through some such exercise. Yes.

7 Q And I presume that you or
8 someone at Imperial, would be able to tell us, the ex-
9 tent to which the 9.5 exceeded the proposed requirements.
10 How much there was going to be left?

11 A I imagine at the time we
12 could. Whether we have a record of those or not I could
13 not be sure Mr. Scott.

14 Q Well, perhaps, if it isn't
15 too much trouble, I could ask you to look and notify Mr.
16 Ballem if you have this kind of information.

17 A I think the statement
18 understands that proposed developments, seen at that
19 time, could be built from Yaya. It doesn't say what
20 other requirements there might be for gravel from Yaya.
21 I believe that our search for sand material indicates
22 that we recognize that the proposed developments should
23 not completely deplete the Yaya gravel supplies.

24 Q I understand that, but
25 really what I'm asking first, is whether in making that
26 judgment, you were able to conclude to what extent there
27 would be a surplus, if the needs, the prime needs of the
28 proposed on-shore developments were taken from that pit.
29 Now, you may or may not be able to answer that question.
30 Depending on how you, on the basis on which you made the

1 statement, but that's the first thing I'm asking. Do
2 you understand?

3 A Yes. I think that the
4 only conclusion we really came to was that there was
5 more gravel ^{than} there/ was presently being called for by the
6 proposed developments.

7 Q But you didn't know by how
8 much or by what volume.

9 A I certainly can't give you
10 that number and whether I have it recorded or not I'm
11 not certain.

12 THE COMMISSIONER: Well, is it right
13 to say then Mr. Mainland that given the present state of
14 affairs, you are not prepared to stand by that statement.
15 Is that your position now? Or do you still adhere to
16 this position? Do you say now that gravel deposits at
17 Yaya are adequate for all proposed on-shore gas develop-
18 ment programs including the building of the trunk pipe-
19 line from Alaska across the delta. Is that your position?

20 A I'm not certain. I don't
21 have a current estimate of gravel requirements for the
22 cross-delta route. I think that by the time Gulf and
23 Shell have described their requirements, the various
24 pieces will be required and will be added together to
25 indicate the total gravel requirements.

26 MR. SCOTT: I'm not being sel-
27 fish, I'm simply asking these; the Beaufort Delta people
28 that are in the room, and I know that they may want to
29 get their hand in this gravel pit too, somewhere along
30 the line. If you have any more precise figures on which

1 this statement is based, I would be grateful if you
2 would make them available.

3 A All right Mr. Scott.

4 Q If you haven't, I under-
5 stand why you haven't.

6 Well now, what other sources
7 are there for good grade material, within economic reach?

8 A Well, other than Caribou
9 Hills, I am not sure of others. Undoubtedly there are
10 some deposits, but how extensive they are or whether they
11 are of a size sufficient to be worth developing, I could
12 not tell you.

13 THE COMMISSIONER: When you say
14 the Caribou Hills gravel deposit, that's the same thing
15 as the Campbell Lake deposit?

16 WITNESS MAINLAND: No sir.

17 THE COMMISSIONER: Oh?

18 WITNESS MAINLAND: This is on
19 the Caribou Hills, north east of Inuvik.

20 THE COMMISSIONER: Yes, and the
21 Campbell Lake --

22 WITNESS MAINLAND: Is south of
23 Inuvik.

24 THE COMMISSIONER: South east

25 MR. SCOTT: I think Mr. Commiss-
26 ioner, Campbell Lakes is really rock, isn't it.

27 WITNESS MAINLAND: Yes. That's
28 right.

29 MR. SCOTT: And makes good rip-
30 rap.

1 THE COMMISSIONER: Right. That
2 is I'm sorry, it threw me.

3 MR. SCOTT: Apart from Caribou
4 Hills, and your general notion that there are some de-
5 posits, do you have any other precise information as to
6 their extent.

7 A No, I don't.

8 Q Now, is the Caribou Hills
9 deposit, all within the IBP site, or is part of it out-
10 side?

11 A I couldn't respond to that
12 Mr. Scott, I'm not sure.

13 Q Well, apart, from Bighorn
14 about which you told us, what are the prospects within
15 economic distance, for lower grade materials, that can be
16 substituted for good grades?

17 A At the present time that's
18 the only source that we have been able to discover. If
19 it proves to be impossible to obtain it, we will probably
20 have to try and look a little further however, as I men-
21 tioned, DIAND is presently also engaged in looking for
22 other materials.

23 Q I take it that it is appar-
24 ent that if one considers more than the proposed develop-
25 ments and puts into the scale the developments that
26 might normally occur over the next generation, that the
27 gravel, the fine and lesser quality gravel situation is
28 critical in this area.

29 A We think it is ^{an} extremely
30 important factor. Yes. I guess I should correct myself

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1 over a statement I made a while ago. There is some
2 gravel in the Parsons Lake area and I believe, Gulf, in
3 their discussion will outline their plans to obtain
4 gravel from there.

5 THE COMMISSIONER: Could we
6 stop for coffee now.

7 MR. SCOTT: Yes, I'm prepared.

8 THE COMMISSIONER: All right.

9
10 (IMPERIAL OIL LIMITED LAND USE APPLICATION,
11 MAPS & CORRESPONDENCE MARKED EXHIBIT 423)
12 (PROCEEDINGS ADJOURNED FOR A FEW MINUTES)
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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. RALLEM: I believe that over the coffee break our witness has been busy and is now in a position to make same statement about flood level. I think that Mr. Scott was asking him about. Would you go ahead Mr. Mainland.

WITNESS MAINLAND: Our studies indicate that we would expect that a possible three to four foot of static water above the ground and a two to three foot wave possibility above that.

MR. SCOTT:
Q With what frequency?

MR. RALLEM: That's the last time we'll volunteer an answer.

MR. SCOTT: Well, obviously if that's going to occur weekly, one set of precautions is desirable. If it's going to occur once every ten years another set may be relevant -- or once every twenty years.

A Any response I gave, I'm afraid Mr. Scott would be pure conjecture on my part.

Q Well, it would be the first conjectural answer in this entire Inquiry. I'd be very surprised indeed. Perhaps you can give some thought to that.

A Those are the design conditions we're using. I think normally one talks about a fifty^{year} situation so I don't we're going to improve on that as an estimate of frequency.

Q Well, perhaps you can let me know if that judgment appears to be incorrect.

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A Yes sir.

Q Well now I would like to just see if I can't bring together the various statements that you have made in your prepared evidence and in your fat volume about employment.

THE COMMISSIONER: Excuse me.
I think Mr. Ballem wanted to --

MR. BALLEM: I think that I just want to tell Mr. Scott that we found yet another report and I know how much he likes reports so maybe you might identify that.

A We were discussing our gravel availability and my impression would be that you are aware of the report by Mollard & Associates, but maybe you're not. It is available. I believe there may be a copy in the Inuvik research lab here. It identifies the majority of the gravel reserves in the delta, being in the Caribou Hills -- something like 95% I believe.

Q There's nothing inconsistent in that report that the evidence that you've given in response to our questions today.

A I'm not really familiar with the report, Mr. Scott, but I don't believe so.

Q No. Well, now let me come to employment figures and would it be correct to say that in general terms a project such as yours goes through three stages. First, a construction stage or phase. Secondly, a kind of break-in phase that may last for a period that runs I suppose from months to

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Cross-Exam by Scott

years. And thirdly, a routine operation phase.

A I think that would be a fair statement, yes sir.

Q Now what I would like to get from you for each of those phases is the -- your present expectation as to the employment roles on an annual basis or on a seasonal basis, if a seasonal basis should be more appropriate. And perhaps we can start off at the wrong end by observing that on page number 14 of your evidence. In the last paragraph you refer to the matter rather indirectly by talking about the housing complex that you are going to build. Say a permanent housing complex with room for up to a hundred people will be provided next to the plant. Permanent plant operating and maintenance staff will number about 65. Well now recognizing that we are dealing with estimates here and projections, is that Imperial's estimate as to the total staff that will be required for the routine operations and maintenance phase?

A Yes, that is correct.

Q Now when you go on to say that that will be increased by the transient presence of work-over crews, summer transportation crews, could you describe for me in a short sentence or two what those are, the numbers that are entailed, and the intervals at which it may be anticipated they will be present.

A No I couldn't, Mr. Scott, but Mr. Todd, who will be a member of our socio-economic panel will be able to provide you with that data.

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Cross-Exam by Mr. Scott

Q Well now let's talk about the break-in phase or the second phase of the complex's operations and what can you tell us there in a general way about the employment roles of Imperial?

A I'm sorry, do you mean employment numbers, Mr. Scott?

Q Employment numbers, yes.

A Once again, I think we should probably defer that to Mr. Todd, but it's obviously going to be a combination of construction people plus some operating people who are starting to take over the operation.

Q And would you prefer to defer to him the question of the volumes in the first phase, the construction phase as well?

A Yes, I think that would be wise.

Q Mr. Hollingworth asked you first off today about your ability to predict the volume of materials, the tonnage that may have to be brought in and you indicated that that was difficult if not impossible to do because everything or a great deal depended on the size of the complex that you propose to build. Now, I presume that you have some estimates based on various scenarios.

A Estimates of tonnage, Mr. Scott?

Q Yes.

A Well, I think I mentioned

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just after lunch that the estimate for the one billion cubic foot per day plant is 41 thousand tons.

Q Does that include the 350,000 barrels of fuel?

A No, sir.

Q In your big book, page 2-7 you deal with the problem of traffic on the Mackenzie. And you refer there to an industry committee currently investigating ways in which other projects may cooperate with the Mackenzie Valley pipeline transportation system for higher efficiency and lower environmental and socio-economic impacts. Well now, first of all, could you tell me something about that committee. When was it established, under whose aegis is it being operated and who's on it?

A The group is formed by I think, of the aegis of Arctic Gas and has had discussion with the three producing companies. I don't believe that the work has progressed very far at this stage because of the -- well, just simply because of the stage at which most of the producer plans have achieved so far. Things aren't definite enough to get much further.

Q Who does the committee report to? The individual companies that compose it?

A Yes.

Q Is the committee charged with considering matters of priorities as between the different companies that compose it?

A I believe the committee was

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Cross-Exam by Scott

really assembled to provide a medium for communication of logistical requirements.

Q Is this the panel to which I should direct questions about flying heights, timing of flights, flight corridors and matters of that sort or should that be directed to the environmental panel?

MR. BALLEM: For what reason? I mean are you speaking first of operational requirements or --

MR. SCOTT: I am speaking of obtaining information about the determination, if any that Imperial has made about corridors, about numbers of flights, about timing of flights.

A You will get a better response from the environmental panel than you will be able to from me Mr. Scott.

MR. SCOTT: Right.

THE COMMISSIONER: Well, just so that Imperial is clear about that, I take it that you are concerned with flights during construction and then afterwards operational?

MR. SCOTT: Yes that's true. Both construction and operational periods. What I am concerned about quite frankly is that Arctic Gas and Foothills have told us in considerable detail about their proposals with respect to corridors and volumes and numbers of flights, not only in the delta, but elsewhere. Now, to a certain extent, this information, while useful, isn't the complete picture until we have the add-on that Imperial and other producers will

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represent by their flights. And what I really want to know is who is going to be able to tell me that? Is it you or is it the environmental panel?

A I can't give you a good response to that. I think we certainly have been concerned about this from the environmental point of view. And I think that panel may be able to give you some help.

Q Well now, in the main book at page 2-78 you refer to Hovercraft and may I ask first of all if you are the panel that will be able to tell us how it is proposed to use Hovercraft ,or if that's also for the environmental panel?

A I don't believe, Mr. Scott, that we have any definite plans for using Hovercraft. I believe we point out that that is one method of transportation.

Q Well maybe I've read the sentence wrong and we should just clear it up. "With the coming of freeze-up, transportation is limited to the use of Hovercraft and helicopters until the channel ice is thick enough to support vehicular traffic." Now, you tell me and I think you are correct that that doesn't amount to a statement that you are going to use Hovercraft. Let me ask you. Are you going to use Hovercraft?

A I'm not sure that I can give you a positive yes or no statement. I guess the best response I can give is that we have analyzed the maximum load which we might be required to move into the

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Cross-Exam by Scott

1 Taglu site and feel that we can take it in by air.

2 Q Would it be correct to
3 say that you haven't made up your mind yet?

4 A Yes, I'm sure that's a
5 correct statement. It's going to depend on the types
6 of transportation available and the various pros and
7 cons. No, we haven't made up our mind.

8 Q Well, in that context it's
9 no doubt a terrific sentence. Number six of your
10 evidence dealing with the subject of wells -- you
11 touch upon the -- Well, let me read the last sentence.
12 "To maintain competence in the near surface permafrost
13 and ensure against slumping, the top sixty feet around
14 the well will be permanently refrigerated." Well now,
15 have the wells that are designed in the fashion you
16 have described ever been used in permafrost?

17 A No sir. There are very
18 few wells that have been used in permafrost other than
19 possibly some in Russia. I don't believe they are
20 designed in this fashion.

21 Q Well, what I'm getting at
22 then, is that while you have designed a well that will
23 meet any difficulties inherent in permafrost, this
24 will be as far as you know, the first occasion in which
25 such a well has been used in permafrost?

26 A Well there are wells being
27 drilled on the north slope of Alaska, which I think
28 may well not use permanent refrigeration at the surface.
29 And I think that's an additional safeguard which we
30 are applying to these wells, partially because of the

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high ice content of the surface at Taqlu.

Q Does that mean that you think you have designed or you have created a design which is more conservative than that used at Prudhoe Bay?

A I'm not really sure if I can say more conservative because I think it depends on the ground conditions and their design is probably very adequate for the ground conditions. We happen to have a high ice content there at Taqlu and feel that this refrigeration is a good conservative move to insure the stability of the surface.

Q Well then it would be correct to say that in high ice content field, this design is utilized for the first time?

A Well, you know we do a very similar thing at the present time when we are drilling the wells, we use a refrigerated conductor pipe, so it's simply applying it to a development situation.

Q But that's in drilling, but in production, this will be the first time?

A As far as I am aware.

MR. SCOTT: Those are all the questions I have. Thank you very much gentlemen.

THE COMMISSIONER: Any re-examination?

MR. BALLEM: I have no re-examination, sir. Thank you.

THE COMMISSIONER: Well

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thank you very much, Mr. Mainland and Mr. Stewart.
We certainly appreciate all that you have told us. I
think that we'll go ahead with the next panel.

(WITNESSES ASIDE)

MR. BALLEM: Mr. Chairman, then
I will call Mr. Robert Elliott Faulkner and Mr. John
William Serra on behalf of Shell and I would ask that
they be sworn.

ROBERT ELLIOTT FAULKNER,

JOHN WILLIAM SERRA, sworn:

THE COMMISSIONER: Mr. Ballem,
just before you begin. Will Mr. Stewart be here to-
morrow too? There were some matters I wanted to ask
him about, relating to reserves and discoveries and so
on? If he's going home tonight, I'll ask him now, but --
WITNESS STEWART: I plan to go
home tomorrow afternoon. I can accomodate your sched-
ule.

THE COMMISSIONER: Remind me
in the morning and I'll raise those matters with you,
Mr. Stewart, if that's all right. We'll carry on now
with this panel.

MR. BALLEM: Would you like us
to start in the morning with Mr. Stewart on the stand?

THE COMMISSIONER: Yes, let's
do that and I'll try to remember the notes I had. I
think they're back in the hotel.

MR. BALLEM: All right, sir.

DIRECT EXAMINATION BY MR. BALLEM:

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Q Mr. Faulkner, would you state to the Commission your full name and business address and position, please.

WITNESS FAULKNER:

A My name is Robert Elliott Faulkner. I am employed by Shell Canada, Limited; Calgary, Alberta. My current position is Division Project Superintendent in our Production Department.

Q And would you briefly run through your academic and professional and business qualifications?

A I graduated from the University of British Columbia in 1964 with the degree of Bachelor of Applied Science in Civil Engineering. I joined Shell Canada, Limited in June of that year as a mechanical engineer in their production department. After some initial assignments in production engineering in Calgary and Edmonton, I spent some three and one half years as an engineer on Shell Canada's west coast off-shore drilling project working on underwater equipment design and drilling operations. Following the completion of that project, I spent approximately three and a half years in off-shore drilling and construction operations with Shell group companies in New Zealand and the United Kingdom. I returned to Shell Canada in late '72 and became involved in planning for a Mackenzie Delta gas development shortly thereafter. I assumed my current position in mid 1974. My responsibilities in that position include planning, organizing and supervising efforts of a group of engineers and foremen involved in the construction of

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oil and gas producing facilities in the conventional producing areas in the western provinces of B.C., Alberta and Saskatchewan. Until recently, my responsibilities have also included some coordination of Shell Canada Limited's plans to develop the Niqlintoak gas reserves in the delta. I have been a registered professional engineer in the province of Alberta since 1966.

Q Thank you Mr. Faulkner. Mr. Serra, would you describe your present position with Shell and your business address, please?

A My name is John William Serra and I am employed by Shell Canada, Limited in Calgary and my current position is Section Leader of the Reservoir Engineering Projects Group.

Q And Mr. Serra would you briefly describe your academic and professional and business qualifications?

A I graduated from the University of Alberta in 1964 with a Bachelor of Science degree in Mechanical Engineering. Immediately following graduation, I joined the Pan American Petroleum Company as a mechanical Engineer. I returned to the University of Alberta and graduated in 1966 with a Master of Science degree in Petroleum Engineering. Immediately following graduation I joined Shell Canada Limited. During the first two years of my career I did research work on steam flooding of Peace River tar sands at the Shell Production Laboratory in Calgary. Commencing at approximately 1968, I specialized in reservoir engineering. During this period

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I carried out various assignments related to drilling, testing and evaluation of both oil and gas wells. Since 1969, I have been extensively involved in mathematical reservoir simulation of petroleum reservoirs. I assumed my current position in 1974. My responsibilities include planning, organizing, leading and controlling the activities of the reservoir projects engineering group. Responsibilities of this group include specified major projects such as field reservoir simulation studies, field performance predictions and optimization, gas cycling projects, infield drilling projects, secondary and tertiary oil recovery in reservoir engineering aspects of new development such as the Mackenzie Delta. I am a member of the Petroleum Society of the CIM and the Society of Petroleum Engineers of the AIME. I've been a registered professional engineer in the province of Alberta since 1967.

MR. BALLEM: Thank you Mr.

Serra. Mr. Commissioner, I now would tender the prepared evidence of the witnesses as an exhibit and I believe Miss Hutchinson has an ample supply of the larger document. I would ask that that be given an exhibit number. There are some slides that will be referred to. They actually in the material itself but I happen by some circumstance to have duplicate slides. Would you like those to be registered, or not?

THE COMMISSIONER: I don't think it's necessary.

MR. BALLEM: I don't think it's really necessary. Very good then, sir. Mr. Faulkner,

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would you proceed with the evidence of Shell Canada,
please.

WITNESS FAULKNER:

I intend to just read the
prepared evidence. Project description. Introduction.

The Niglintgak gas development project planned by Shell Canada Limited will process a maximum of 150 million standard cubic feet per day of raw non-associated natural gas reserves from the Niglintgak field in the Mackenzie River Delta Region of the Northwest Territories. The gas reserves in the Niglintgak structure have been only partially delineated and therefore the information presented herein represents our best judgment at this time as to the manner of development of the accumulation. Shell Canada Limited anticipates that further delineation drilling and engineering studies will result in changes to the development plan described herein but the general scope of the project should not alter significantly.

Until recently Shell anticipated that gas produced from the Niglintgak accumulation would be transported to and processed at a gas plant at Taalu (some 10 miles east of Niglintgak), that's the project that we have just heard described -- owned and operated by Imperial Oil Limited. Shell has now evaluated a number of alternative processing schemes and has concluded that the Niglintgak accumulation can best be developed by processing the gas in a plant constructed and operated by Shell at Niglintgak.

The major surface facilities

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1 making up the proposed Niglintgak gas development
2 project are shown in Figure 1. Bob, maybe we could
3 have that slide? -- It needs a warm-up period.
4 The gas processing plant and major support facilities
5 such as living accomodations, helicopter pad and ware-
6 house will be located near the projected geographic
7 centre of the Niglintgak gas reserves. Well locations
8 have been selected to provide adequate drainage points
9 for the multiple non-associated gas bearing sands and
10 fault blocks making up the Niglintgak accumulation.
11 Well depths and designs vary from location to location
12 depending on the depth and number of producing zones to
13 be encountered. The unloading dock and staging area
14 will be located on the Kumak channel, east of the plant
15 site, to take advantage of the deep water that occurs
16 naturally along that stretch of the river.

17 THE COMMISSIONER: You're on
18 the middle channel of the Mackenzie, are you?

19 A That's correct, yes. The
20 middle channel is indicated there and in our par-
21 ticular area, it is a very shallow channel. There's
22 a lot of sand bars and that sort of thing. The main
23 flow tends to go down the Kumak channel.

24 THE COMMISSIONER: In the--
25 currently barge traffic uses what channel -- the Kumak?

26 A The Kumak channel, yes.
27 Two major gathering lines, one serving the north end
28 of the field and the other the south end of the field
29 will transport well production to the central gas pro-
30 cessing facility. The gathering lines will be supported

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1 above ground on pile supports except for the line segment
2 servicing the most southerly well where the Kumak chan-
3 nel crossing may require burial of the line if it can-
4 not be suspended. However, we are still studying
5 the technical and economic feasibility of tying in
6 this well. Gathering line segments will vary in size
7 from approximately 8 inches to 16 inches in diameter
8 and will be designed to withstand a maximum operating
9 pressure of approximately 1400 psig and a maximum gas
10 temperature of 100°F. The gathering lines will trans-
11 port raw gas to the central gas plant where all pro-
12 cessing will take place.

13 The central processing plant
14 pad, well pads, the road and the dock and staging area
15 will be constructed of native granular construction
16 materials. The closest proven source of gravel is the
17 Yaya Lake deposit located approximately 30 miles
18 south east of the plant site. The Yaya Lake deposit
19 and the anticipated gravel haul route is shown on
20 Figure 2.

21 This is a slide quite similar
22 to the one you've seen previously. The area from which
23 the gravel will be taken is in much the same area as
24 we've talked about before.

25 Figure 1, and maybe we can go
26 back to that, Bob, also indicates a possible route for
27 a sales gas transmission line lateral to be cons-
28 tructed by others. The actual location of the line will
29 be determined by the transmission line operator at a

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1 later date and the connection to the transmission line
2 will be located at the gas plant gate. The gas plant
3 design includes gas refrigeration facilities in an-
4 ticipation that the transmission line will be buried
5 below ground and will transport chilled gas.

6 The existing Farewell staging
7 area currently operated by Shell as a base for ex-
8 ploration operations in the delta area is located ap-
9 proximately 10 miles south of the proposed Niglintgak
10 gas plant. Shell Canada Limited intends to use Farewell
11 as an operations center during the development drilling
12 and certain construction phases of the project and as
13 a transfer point for personnel and air cargo once the
14 gas plant is operational. Personnel and cargo travelling
15 to the Niglintgak plant will be flown to the Farewell
16 staging area by fixed wing aircraft and then on to the
17 plant by helicopter. An all weather airstrip suitable
18 for STOL aircraft has already been constructed at the
19 Farewell site. Shell assumes that the Farewell staging
20 area will be operated by Shell and/or other operators
21 during the life of the Niglintgak project as a base
22 for exploration and drilling operations in the region.

23 A few comments on reserves.

24 The Niglintgak structure is a long narrow anticline with
25 the major axis running approximately north west and
26 south east. The structure is transected by several
27 faults that create discontinuities in the gas bearing
28 sands and may create separate non-communicating fault
29 blocks within the structure. The structure also con-
30 tains a number of different sands varying in depth from

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approximately 2600 feet to 7000 feet below ground elevation that contain non-associated gas reserves. Gas reserves contained in the various sands are at different temperatures and pressures and also show minor variations in composition. The major portion of the reserves are contained in the shallowest sands at relatively low pressures.

Shell estimates that the recoverable non-associated sales gas reserves in the Niglintgak accumulation total 887 billion standard cubic feet (BCF). This total is comprised of 402 BCF proven reserves, 301 BCF probable reserves and 184 BCF possible reserves. These totals have been derived on the basis of data obtained from the wells drilled on the structure prior to the Niglintgak B-19 test that is currently being drilled. Shell Canada Limited anticipates that the B-19 well will transfer -- or will allow the transfer -- of significant additional reserves from the probable and possible categories into the proven category and may result in an increase in the total estimated reserves in the accumulation.

Table 1 -- and maybe we could have slide three, Bob -- provides a representative composition of the gas stream to be processed in the Niglintgak gas plant over the life of the field. The composition is based on a mixture of production from the shallow and deeper gas zones in the structure. The shallow gas zones contain in excess of 98% methane and only trace amounts of the heavier hydrocarbons. Gas from the deeper sands is somewhat richer in the heavier

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hydrocarbons. The blend of the two gas streams will provide an inlet stream to the plant that contains approximately two barrels of recoverable liquid hydrocarbons that's the pentanes plus category -- per million cubic feet of gas. The liquid hydrocarbons recovered during processing will normally be burned as plant fuel.

You will also notice from that that the total sulphur in all of the sands that we have looked at is nil.

Preliminary reservoir engineering studies indicate that the Niglintgak gas reserves can be adequately drained with the 10 wells shown on Figure 1. Several of these wells will be completed with dual tubing strings to allow concurrent production of both deep and shallow gas reserves within the same wellbore. The remaining wells will be single zone completions in the shallow sands only. The widely separated locations of the 10 development wells eliminates the possibility of using cluster drilling concepts for all wells with the possible exception of the four locations in close proximity to the gas plant. Further design is required to determine if the four centrally located wells can be directionally drilled from a single surface location. For the present, we have assumed that ten separate drilling pads will be required, one for each well.

The most southerly well in the proposed development is physically separated from the remainder of the Niglintgak project by the Kumak channel. There are several factors that must be better defined before the tie-in of this well to the remainder

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of the system can be considered physically and/or economically viable. Very little is known at this point in time of the physical characteristics of the Kumak channel in the vicinity of the proposed pipeline crossing site or of the feasibility or cost of constructing either a buried or suspended pipeline crossing in this stretch of the river. Limited hydrological survey data in the area suggest that a crossing of any sort would be extremely expensive to construct and moreover would have a high potential of accelerating riverbank erosion along the north shore of the channel if the design was not adequate. Shell has elected to include this well site in the present development plan as it is the only feasible surface location from which the shallow gas reserves underlying the region (estimated to be 6 - 8% of the total Niglintgak accumulation) can be drained. Shell intends to carry out additional work regarding the feasibility of drilling and tying in this particular well and we understand that a rigorous examination of the proposed river crossing design would be carried out by the Department of Indian Affairs & Northern Development before a construction permit for such a crossing would be issued. In any event, Shell believes that the gas reserves that can be drained from wells located north of the Kumak Channel will be sufficient to support the proposed Niglintgak plant if the river crossing does not prove to be physically or economically viable.

Land requirements. Maybe we could go back to Figure 1 again, Pob. Figure 1

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defines the approximate surface locations on which Shell will construct the permanent facilities comprising the Niglintgak gas development project. These land requirements include:

- (a) The surface leases required for the ten gas well locations, the gas plant and associated support facilities, the dock and staging area and the access roads.
- (b) An additional surface lease located adjacent to the gas plant that will be required for the installation of supplementary gas compression facilities during the latter years of the project.
- (c) The easements required for the gas gathering lines including both the above ground portions of the gathering system and the proposed buried --buried should probably be struck there -- the proposed crossing of the KumaK Channel.

As noted in the Introduction, Shell also intends to make use of the existing Farewell staging area and airstrip in constructing and operating the Niglintgak development. The staging area and airstrip are currently held by Shell under a renewable five year lease arrangement from the Federal Government, Department of Indian Affairs and Northern Development. Shell anticipates that the facilities located at Farewell will be operated by Shell and/or others for many years to come and that said facilities, particularly the airstrip, will be available to Shell throughout the life of the Niglintgak project.

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located approximately 25 miles south east of the proposed gas plant site will be the principal source of the granular materials required for the Niglintgak project. Shell anticipates that approximately 800 thousand cubic yards of gravel will be required from the Yaya deposits during construction of the project and that a further 50 thousand cubic yards per year will be required throughout the life of the project for maintenance purposes.

Drilling and completion. Drilling of the majority of the producing wells (anticipated total of 10) required to drain the Niglintgak accumulation will probably be drilled commencing in 1978 or 1979 and be carried out as a continuous one rig program until drilling and completion activities are completed. Shell hopes to re-enter and complete both the M-19 well (suspended in 1975) and the currently drilling B-19 well as production wells in the shallow sand package. If re-entry and completion operations are successful, the number of additional wells will be accordingly reduced.

Wells will be drilled by a drilling contractor under the supervision of Shell. Drilling supplies and fuel will be stockpiled at the Farewell staging area and transferred to each drilling site as required over ice roads in the winter months or via helicopter during the remainder of the year. Resupply of the Farewell staging area will be conducted each summer by river barge from Hay River.

Production well depths will vary

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from approximately 4000 feet true vertical depth (TVD) for a shallow sand producer only to approximately 7000 feet TVD for a well that is also completed in the deeper sands. Elapsed times including rigging up, drilling and dismantling equipment in preparation for movement to the next location will probably vary from 90 to 120 days per well depending on well depth. All wells are located within the Kendall Island Bird Sanctuary and the timing of rig moves will be governed by restrictions laid down by government regulatory authorities. Following drilling operations, wells will be suspended without production tubulars to guard against possible well damage from potential freezeback problems.

At this time Shell anticipates that development drilling at Niglintgak will be carried out using a helicopter transportable drilling rig similar in design to the exploration rigs that have been under contract to Shell in the area for several years. The helicopter transportable rig can be moved from location to location during periods of the year when winter roads cannot be constructed and should minimize rig standby time, particularly in a field like Niglintgak where well locations are widely spaced and are not planned to be linked by permanent roads.

The rig will be entirely self contained, complete with electrical power generation facilities, fuel storage, utility systems and living accommodations for about fifty men. The major pieces of drilling equipment, drawworks, rotary table, mud pumps, etc., will probably be electrically powered D.C. units

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fed from primary diesel - electric generator sets.

Blow out prevention equipment and casing programs employed in drilling production wells will meet Company and Federal Government standards.

The rig substructure will be supported on a prepared timber pile foundation to ensure that adequate support is provided under this critical area of the rig. Pile supports may also be installed under other heavily loaded portions of the rig but the majority of the rig facilities can probably be set directly on the gravel pad surface.

As with current exploration wells several operations, namely the construction of pile foundations, a drilling sump and the installation of the initial string of casing or conductor pipe, will be completed by construction crews prior to the arrival of the drilling rig. Present practice consists of setting 26 inch diameter conductor pipe to a depth of 60 feet below ground surface. The upper 30 feet of the conductor pipe are fitted with refrigeration coils to ensure that the surface layer of permafrost remains competent during drilling operations.

Drilling operations below the conductor pipe will be carried out by the drilling rig itself. Well designs and casing setting depths will vary from site to site depending primarily on whether or not the well will be completed as a dual or single zone producer. Figure 4 depicts a typical well design envisaged by Shell for a shallow single zone producing well. A dual zone producing well will incorporate

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similar design features but casing and tubing sizes and setting depths will vary accordingly.

The producing well design contained in Figure 4 differs from current explorations wells in one significant aspect, the elimination of the so-called permafrost casing string that regulations require to be set at 500 feet. I should maybe make one point of clarification. Since the time our written evidence was prepared it has come to my attention that surface casing requirement has been waived for certain other drillers as well and the B-19 well that we are drilling at the moment does not have that particular string in it. The 26 inch surface casing string will be set at approximately 1100' and the 13-3/8 inch casing will be set at approximately 2400 feet above the overpressured shallow gas zones that have been encountered routinely in drilling at Niqlintgak.

Well facilities and gas gathering system. A gravel pad will be constructed at each well location which will be large enough to contain the required well facilities and also serve as a work area for a workover rig if it is required in the future. Present plans call for a gravel pad of about 200' by 300' dimensions and sufficiently thick to prevent permafrost degradation. A dyke will be constructed around the pad to protect the area from seasonal flood and to contain minor spillages.

The wellhead will be located within the pad area and would consist of the master valves and also a surface safety valve. The surface

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safety valve will be able to operate manually or automatically and will also be able to be activated remotely from the gas plant. An orifice meter will be located downstream of the surface safety valve to measure production from each well. This meter will also be capable of being monitored from the gas plant along with pressure, temperatures and other functions at each well location.

A lineheater will be required at each well to raise the produced gas temperature sufficiently to prevent hydrate formation in the gathering line. The lineheater will be an indirect fired type and will burn raw wellhead gas as fuel. A building will house part of the lineheater to provide a warm area for the controls and valves required and will also contain the above mentioned orifice meter.

Methanol and corrosion inhibitor injection pumps will be provided at each well location and will be housed in a small heated building. These pumps will be capable of injecting chemicals into both the production well and the gathering line to prevent hydrate formation and corrosion. The methanol and corrosion inhibitor will be stored in small metal tanks located on the pad and will be surrounded by a dyke with sufficient capacity to contain spills.

A flare knockout drum, recycle pump and flare stack will be provided to permit blowdown of facilities located on the pad for maintenance or repair. The flare knockout drum will likely be housed in the line heater building

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and the recycle pump will be located in the methanol pump building. Liquids separated in the flare knockout drum will be stored in a steel tank located within the dyke with the methanol and corrosion inhibitor tanks. Liquids will be pumped back into the gathering line from the storage tank with the recycle pump.

Pig injector facilities will be installed at the well locations to permit pigging of the gathering line if required. These facilities will also allow a linalog device to be run through the gathering system to check for corrosion.

A field gathering system will be required to transport gas from the producing wells to the processing plant. Gathering system routes are depicted in Figure 1. The gathering system will consist of common gathering lines transporting gas from a number of wells. A detailed hydraulic analysis has not been carried out but preliminary calculations indicate line sizes will ^{vary} from 8" to 16" diameter.

The lines will be founded on pile supports at an elevation above the ground that is sufficient to ensure the lines would be above maximum anticipated flood levels and storm surges. The lines will be horizontal or sloped slightly, if possible, towards the gas plant to prevent liquid hold-up.

All lines will be insulated and heat traced. The insulation will be thick enough to maintain the gas temperature above the hydrate point under normal flowing conditions. Under upset condition such as low flow or start-up or shut-down, the

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1 heat trace system will be activated to maintain the gas
2 temperature above the hydrate point. The heat trace
3 system will be equipped with temperature sensing
4 devices so that it will be automatically activated
5 when the temperature drops to a predetermined level.

6 The Shell Niglintgak Gas Plant
7 will be built near the geographic centre of the Niglint-
8 gak accumulation. The plant will be designed to process
9 150 million cubic feet per day of raw gas to meet pipe-
10 line gas quality specifications. A representative analy-
11 sis of the gas stream to be processed is provided in
12 Table 1. The gas stream does not contain any hydrogen
13 sulphide, or sulphur in any form. Table 2 provides a
14 material balance for the Niglintgak gas plant.

15 All plant facilities will be
16 enclosed in heated and insulated buildings connected
17 by a system of utilidors which will carry utilities and
18 provide protected passage between buildings for personnel
19 and vehicle traffic. I'm not sure that that's not a
20 mistake. We can come back to that. Plant buildings
21 will be founded on piles above a prepared gravel pad to
22 prevent thermal degradation of the permafrost and to
23 provide elevation above flood levels.

24 At the Niglintgak plant, the
25 raw gas will undergo initial gas-liquid separation after
26 which it will be dehydrated and then refrigerated to
27 remove liquifiable hydrocarbons. The residue gas will
28 then be compressed, cooled, and delivered to the sales
29 gas transmission system. Recovered liquids will be used
30 as fuel. Aerial coolers will be used throughout the

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1 process in lieu of providing a cooling water system.

2 A glycol/water, heat medium system will be used for process
3 and building heating. Gas turbines will likely be used
4 as prime movers for gas and propane compression and
5 power generation.

6 Support Facilities. Support
7 facilities will be provided to make the gas plant
8 completely self-sufficient. The plant will have a
9 warehouse with an inventory of spare parts and supplies
10 and a maintenance shop for routine equipment repair.
11 Accomodation and recreation facilities will be provided
12 at the plant site for the operating staff. Helicopter
13 pads will be provided at the plant and at remote well
14 locations and a river dock will be provided on the
15 Kumak Channel for the unloading of supply barges.
16 The utility systems will include raw water treatment and
17 sewage treatment facilities, gas turbine driven power
18 generators, process and building heating systems
19 and a voice and data communications system between the
20 plant and well sites, and the plant and Calgary.

21 Construction. First the well
22 pads and facilities. Gravel-pad construction at the
23 well sites will involve moving and placing large amounts
24 of gravel. Open sumps suitable for containment of
drilling fluids and sewage will be constructed in
preparation for the arrival of drilling rigs. The
work will be carried out chiefly in winter. It is
anticipated that gravel will be transported to the site
over snow or ice roads directly from the pits. Heavy
construction equipment will be used, and crews will be

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housed at a central base camp and transported daily to and from the construction site.

Permanent facilities to be located at each well site will be erected as a part of the gathering system construction activities noted below.

Gas plant. Work carried out by the prime contractor and his subcontractors will include preparing the site, moving and placing gravel or sand, installing piles for foundations, constructing a dock, erecting large field-fabricated storage tanks, and, if necessary, some dredging. Work done elsewhere will include the fabrication of large and small complete modules which will be installed on site to form the plant. Work at the Niglintqak site will include interfacing, testing, and commissioning the pre-fabricated modules, and erecting buildings including workshop, warehouse, garage, utilities, control room, and both permanent and temporary housing.

(c) The gas gathering system. Construction of the pipeline systems linking producing wells to the gas processing plant will be carried out in winter, except for certain activities at well or plant sites where work will be confined to gravel pads. Crews will be accommodated at central base camps and transported daily to and from the construction site. Activities along the right-of-way will consist primarily of the following phases: 1. Preparing the right-of-way, clearing brush and preparing snow roads to carry construction vehicles. 2. Constructing pile supports

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1 and positioning, welding, and that should be installing
2 the pipe. 3. Pressure-testing the completed installation.
3 Heavy equipment will be required in all phases. Pile
4 foundations will be sunk at least a month before pipe-
5 laying, to be sure the piles were properly frozen in
6 before being loaded. Pipe assembly facilities will be
7 set up at the central base camp, and as much pre-
8 fabrication as possible will be carried out before trans-
9 porting pipe sections to the installation site.

10 D. The construction schedule.

11 The nature of the project will require that certain
12 activities must be accomplished during specific times
13 of the year.

14 Specifically, all major ship-
15 ments of material will have to be made in summer,
16 while many other activities, such as gravel hauling,
17 may be better carried out while the ground is frozen.

18 Scheduling will be designed to
19 level work loads, allow projects to be carried out in
20 the most suitable season, ensure efficient logistics
21 support, and provide maximum protection for the
22 environment.

23 Figure 3 -- maybe we could
24 have that slide? Thank you. -- presents current best
25 estimates of the construction schedule required to
26 meet a plant start-up date of 1981.

27 Transportation and logistics.
28 Transportation requirements to construct and operate
29 the Niglintgak gas development project will include
30 several methods of travel including aircraft, barges,

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and various modes of overland vehicles possibly including Hovercraft.

Primary air traffic from southern Canada will make use of the Inuvik airport. Personnel and air cargo destined for the Niglintgak plant will be transhipped to the Farewell staging area located some ten miles south of the plant by fixed wing short take-off and landing aircraft and from there to the plant by helicopter. There will be no permanent airstrip constructed at Niglintgak.

Barge traffic on the Mackenzie River system will transport such materials as fuel, chemicals, drilling rigs and supplies, construction equipment and smaller construction materials.

Larger construction materials and gas plant modules will be transported to the site via ocean going barge from Vancouver or other west coast ports. Offloading and transportation of modules will be by self-powered transporters.

Site preparation at the plant area, the dock and staging area, and the road between the staging area and the plant will be carried out before arrival of the modules, to provide an all-weather surface to carry the module loads.

Operations. Both the gas plant and field facilities will be operated from a central control room located at the plant site. The plant and field facilities will be self-supporting as far as qualified operations and maintenance personnel are concerned, with a crew of about 15 men on site at all

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time. A maintenance shop will be provided to service the plant and field equipment. An airstrip is presently available at the nearby Shell Farewell staging area. The operating and maintenance crew will be flown into this airstrip and from there will be taken to the plant site by helicopter. The crews will rotate on a 2 week in, 2 week out basis. Accommodation facilities will be provided at the plant site for the crew. A large proportion of the equipment and supplies for the plant will be brought in by barge to the river dock and barge unloading facility on the Kumak Channel. The dock and all other remote facilities will be operated by staff housed at the Niglintgak plant.

All well facilities will be designed to operate completely unattended and as trouble free as possible. End devices strategically located at the wells and tied into the gas plant will permit remote monitoring of well operations from the gas plant.

The surface safety valve located at each well site will be designed to automatically shut-in if unusual temperature or pressure conditions occur in the well facilities. The valve will also be capable of being remotely shut-in from the gas plant if required.

Routine inspection visits will be made to each well by plant personnel to examine the equipment to ensure that it is functioning properly. These inspections will occur daily during initial start-up, however after the facilities have been operat-

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ing satisfactorily for a period of time they would become less frequent.

Another activity which might occur infrequently at the well locations will be a workover to repair mechanical equipment in the production well. This type of operation will require the use of a workover rig to carry out the work. The well pad will be designed so that sufficient space is available to accomodate a workover rig, tankage and other items required to carry out this type of operation. Workovers will be scheduled so that the workover rig and equipment could be moved onto the well pad over winter roads or by helicopter to prevent damage to the terrain. And that is the end of our prepared evidence.

MR. BALLEM: Thank you Mr. Faulkner. I notice, Mr. Commissioner, we seem to be right on 5 o'clock. What is your pleasure?

THE COMMISSIONER: Well, I think we'll adjourn then till 9:30 in the morning.

(QUALIFICATION & EVIDENCE OF FAULKNER & SERRA
MARKED EXHIBIT 424)

(NIGLINTGAK GAS DEVELOPMENT PROJECT DESCRIPTION
MARKED EXHIBIT 425)

(PROCEEDINGS ADJOURNED TO JANUARY 23, 1976)

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Inquiry

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MACKENZIE VALLEY PIPELINE INQUIRY

Government
Publications

IN THE MATTER OF APPLICATIONS BY EACH OF

(a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A
RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS
CROWN LANDS WITHIN THE YUKON TERRITORY AND
THE NORTHWEST TERRITORIES; and

(b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY
THAT MIGHT BE GRANTED ACROSS CROWN LANDS
WITHIN THE NORTHWEST TERRITORIES,

FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND
ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION
OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE
PROPOSED PIPELINE

(Before the Honourable Mr. Justice Berger, Commissioner)

Inuvik, N.W.T.

January 23, 1976

PROCEEDINGS AT INQUIRY

Volume 115

CANADIAN ARCTIC
GAS STUDY LTD.

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APPEARANCES:

Mr. Ian G. Scott, Q.C.,
Mr. Stephen T. Goudge,
Mr. Alick Ryder and
Mr. Ian Roland for Mackenzie Valley Pipeline
Inquiry;

Mr. Pierre Genest, Q.C.,
Mr. Jack Marshall, and
Mr. Darryl Carter for Canadian Arctic Gas
Pipeline Limited;
Mr. Reginald Gibbs, O.C.,
Mr. Alan Hollingworth &
Mr. John W. Lutes, for Foothills Pipe Lines Ltd.;

Mr. Russell Anthony &
Pro. Alastair Lucas for Canadian Arctic Resources
Committee;

Mr. Glen W. Bell and
Mr. Gerry Sutton, for Northwest Territories
Indian Brotherhood, and
Metis Association of the
Northwest Territories;

Mr. John Bayly
or
Miss Leslie Lane for Inuit Tapirisat of Canada,
and The Committee for
Original Peoples Entitle-
ment;

Mr. Ron Veale and
Mr. Allen Lueck for The Council for the Yukon
Indians;

Mr. Carson H. Templeton, for Environment Protection
Board;

Mr. David Reesor for Northwest Territories
Association of Municipal-
ities;

Mr. Murray Sigler for Northwest Territories
Chamber of Commerce.

Mr. John Ballem, Q.C., for Producer Companys;

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John William SERRA

- Cross-Examination by Mr. Hollingworth

- Cross-Examination by Mr. Bayly

- Cross-Examination by Mr. Scott

Barry Deane STEWART

- Cross-Examination by Commissioner

Robert H. SCOTT

John C. STAMBERG

Howard T. GUYN

William K. GOOD

- In Chief

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- Cross-Examination by Mr. Bayly

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Inuvik, N.W.T.

January 23, 1976.

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

THE COMMISSIONER: Well, we'll come to order. My apologies for being late. I was going to ask Mr. Stewart some questions based on the evidence that Mr. Blair of Foothills gave at the Norman Wells hearing, but the transcript I have doesn't seem to be the one in which his evidence appears, so I'll see if I can locate that at the coffee break and perhaps we could come back to you then, Mr. Stewart.

MR. BALLEM: Just one other minor matter, Mr. Commissioner. As I said at the start, we have filed a limited number of response to information requests for socio-economic supplementary concerns. We filed about four of those some time ago, but they do contain what seems to be a great deal of useful information and they have evoked a fair amount of interest, so we have today made available through Miss Hutchinson the regular 30 or more copies, and to anyone who wants them they are available.

THE COMMISSIONER: Fine, thank you, Mr. Ballem.

MR. BALLEM: I take it we have finished the evidence in chief of the Shell panel, and these gentlemen are now available for cross-examination by my friends.

MR. MARSHALL: I have no questions, sir.

Faulkner & Serra
Cross-Exam by Hollingworth

1 ROBERT ELLIOTT FAULKNER,

2 JOHN WILLIAM SERRA, resumed:

3 CROSS-EXAMINATION BY MR. HOLLINGWORTH:

4 Q Do I understand from
5 the material that's been filed that you haven't as yet
6 selected a treatment system for waste water and solid
7 sewage?

8 WITNESS FAULKNER: That is
9 correct. Our design is not to the point where we have yet got
10 to that sort of detail.

11 Q Do you know when you
12 might be selecting one?

13 A This is my estimate only.
14 We should have a consultant engaged for the detailed
15 work later this spring, and I would guess that we
16 will have that sort of detail the end of summer or
17 something like that.

18 Q Will you be filing that
19 with the Department of Indian Affairs & Northern
20 Development?

21 A I would expect that we
22 will have to provide that sort of detail and we'll
23 certainly be prepared to do so, yes.

24 Q On figure 3 of your
25 prepared testimony, you have under the "activity
26 of engineering" you have two lines, one saying "Phase
27 1" and one saying "Phase 2". Could you explain those
28 terms, please?

29 A Yes sir. In very rough
30 definition, Phase 1 engineering is what we consider
31 will have to be done in order to bring us to the point

Paulkner & Serra
Cross-Exam by Hollingworth

1 where we will be in a position to place orders for the
4 major long delivery materials that will be required for
3 our project. Phase 2 would then be that further phase
4 of detailed engineering that can be deferred beyond
5 that time, and our point in breaking up our engineering
7 activity in this fashion, I think, is to allow us to
7 get done what has to be done and then, if necessary,
6 defer the second phase until we are more certain that
8 the project will go ahead.

10 Q Would both your terms,
11 "Phase 1" and "Phase 2" comprise what has been called
12 at the Inquiry to date "final engineering"? Final
13 design?

14 A Final design, I guess
15 is not our term, but yes, it will be -- it will go
16 beyond the conceptual sort of design which we have been
17 engaged in up till now and it will be dealing with
18 site specific engineering design for the particular
19 project that we have described here yesterday.

20 Q Do you have any figure
21 for the total tonnage of materials required to construct
22 the plant at Niglintgak?

23 A No sir, I do not.

24 Q You have no estimate at
25 all?

26 A I personally don't.
27 We could probably come up with a ball park estimate
28 and submit it later, if that were required.

29 MR. HOLLINGWORTH:
30 Could you provide that
31 figure for me, Mr. Ballem, because it would assist us

Paulkner & Serra
Cross-Exam by Hollingworth

1 in making our logistics plans for --

2 MR. BALLEM: Yes, Mr. Holling-
3 worth, we'll undertake to do so. A ball park figure,
4 I understand, was our undertaking, but we'll make it
5 available.

6 MR. HOLLINGWORTH: And further,
7 is it possible to have a ball park figure for each of
8 the gas plants, the construction equipment required,
9 the gathering line material and the well-drilling
10 equipment, can it be broken down that way?

11 A I would expect so.

12 Q I would understand further
13 from your figure 3 that your use of the transportation
14 system in the north would be in the summers of 1978-79,
15 and 1980, is that right?

16 A That's what we'd infer
17 from our schedule, yes sir, and that's our best
18 belief at this time.

19 Q And are you planning to
20 bring material around via the ocean route the same
21 way that Imperial Oil is?

22 A Yes, we are. I believe
23 I touched on that in the prepared evidence yesterday,
24 and our intent would be much the same as Imperial
25 talked of yesterday, with the larger plant modules
26 we would anticipate having assembled on the West Coast
27 and brought around by sea-going barges.

28 Q Well, again referring
29 to figure 3, you have items placed around the shipping
30 seasons for 1977, '78, '79, and '80, and you have

Faulkner & Serra
Cross-Exam by Hollingworth

1 modules only for 1980. Is it fair to infer from that
2 that you plan to use the Mackenzie River system for
3 the balance of the years?

4 A I think that is fair to
5 assume. I wouldn't like to get myself tied to that
6 statement, but I think that's right. We anticipate that
7 all of our modules can come up in one summer shipping
8 season and I think at this point in time we would not
9 foresee a requirement for further sea-going barge
10 traffic.

11 Q Could you check on that
12 and give me a statement you could tie yourself to?

13 MR. BALLEM: I wonder if you
14 really can at this stage of the planning? I think
15 that's --

16 MR. HOLLINGWORTH: I just
17 asked him if he could, Mr. Ballem.

18 A I think as Mr. Ballem
19 no, I don't believe
20 has inferred, we could because our planning is certainly
21 much less farther along than plans Mr. Mainland described
22 yesterday for Imperial, and I don't think we'd want
23 to close any doors at this point in time.

24 Q Well, Mr. Faulkner,
25 you're talking about ordering materials in the early
26 part of 1977. When do you expect you're going to have
27 this sort of information?

28 A Well, it will tie in
29 with our Phase 1 engineering schedule that has been
30 laid out on this development chart. As you can see
31 there, we have not scheduled this Phase 1 detailed

Paulkner & Serra
Cross-Exam by Hollingworth

1 engineering to even begin until near the middle of this
2 year, and I would anticipate that we will be a good
3 portion of the way through that Phase 1 before we will
4 have more definitive construction schedules prepared.

5 Q Now, I realize you can't
6 give me total tonnage figures, but are you able to
7 tell me which proportion of your total is likely to
8 be shipped around by ocean-going barge, and which is
9 likely to be shipped up the Mackenzie Valley system?

10 A Not percentagewise, but
11 yes, in general terms I think our intent at this moment
12 is that the large gas plant modules that will be built,
13 we assume on the West Coast, will be the primary tonnage
14 that will be brought around by sea-going barge. The
15 remainder of the materials, construction equipment,
16 drilling rigs, drilling equipment, food supply -- well,
17 non-perishable food supplies -- all that sort of
18 thing, we would anticipate bringing up the Mackenzie
19 Valley shipping corridor provided there is the barge
20 capacity available there.

21 Q But you're unable to
22 tell me what percentage your gas plant modules would
23 be of your total tonnage requirements?

24 A At this time, that's
25 correct. I'm sure that we could give you an approxi-
26 mate percentage when we give you some of this other
27 information you've requested.

28 Q Could you do that,
29 please?

30 A It's a tonnage percentage

Faulkner & Serra
Cross-Exam by Hollingworth
Cross-Exam by Bayly

1 you're interested in, rather than a volume percentage
2 or something like that?

3 Q Yes. If you could
4 describe each heading with a general class, then I
5 could get some appreciation of the volume from that.
6 Mr. Faulkner, could I get you to add fuel to that
7 list as well?

8 A Yes sir.

9 MR. HOLLINGWORTH: Thank you,
10 gentlemen, those are all the questions I have.

11 THE COMMISSIONER: Did I
12 understand you to say to Mr. Hollingworth that you're
13 unable to indicate what your capital cost of the
14 project is likely to be?

15 A No sir, I didn't make
16 that statement.

17 Q Could you tell me what
18 the capital cost in round numbers of the gas develop-
19 ment project that Shell intends to undertake is going
20 to be?

21 A Yes, sir. Our current
22 best estimates for the system described herein are
23 -- is between 100 and \$150 million, and those are
24 uninflated 1975 dollars.

25 THE COMMISSIONER: Thank you.

26 CROSS-EXAMINATION BY MR. BAYLY:

27 Q Mr. Faulkner, just
28 following on from the line of questioning that you
29 have been through with Mr. Hollingworth, have you had

Faulkner & Serra
Cross-Exam by Bayly

1 negotiations with the common carriers, N.T.C.L. or
2 any others with regard to the use of their systems to
3 bring your material down river either from Hay River
4 or Fort Simpson, starting in either 1978 or '79?

5 A No sir, Mr. Bayly.

6 I think it's fair to say that the status of our project
7 on that is very similar to the conditions that were
8 described yesterday by Mr. Mainland. There has been a
9 committee structured to deal with this problem, but to
10 date there has been very little identified in the
11 way of positive actions that are going to have to be
12 required by Mackenzie River carriers or others to
13 accommodate the total load that might have to come
14 down the river system.

15 Q And then you are not
16 at the stage of even being able to tell them how much
17 material would be coming down, and therefore they
18 wouldn't be able to plan for how many new barges or
19 new facilities they might need.

20 A Well, let me say I'm
21 sure we are at a stage where we can give them an
22 estimate for the project that we think -- well, that
23 we have described herein. But we have not given those
24 figures to the barge transportation companies, no.

25 Q So you're in that posi-
26 tion but you haven't done so yet.

27 A That's -- I think that's
28 a fair enough statement, keeping in mind that the
29 word "estimate" --

30 Q I appreciate that.

Faulkner & Serra
Cross-Exam by Bayly

1 A -- and the limits of
2 accuracy on the word "estimates" one can make, but I
3 think yes, that could be done.

4 Q And part of that's because
5 you haven't made a decision yet about what proportion
6 of the equipment will be travelling by way of the
7 Bering Strait route as opposed to the land and the
8 Mackenzie River route.

9 A I suppose that is part of
10 it, Mr. Bayly, but I think a larger factor is just that
11 our design is at such a preliminary state that we have
12 very little pinned down in definitive terms. Estimates
13 we can prepare, but they will be less reliable estimates
14 than we will have in six, eight months from now when
15 we have been able to have our consulting engineers
16 carry out enough design work that they have a better
17 handle on the whole thing.

18 Q How much lead time does
19 the barging company need, or do you have any idea of
20 that, to be able to plan for your portion of the impact
21 of this entire project on their facilities?

22 A Sir, I'm afraid I can't
23 answer that question. I can't provide any reliable
24 answer to that.

25 Q They haven't given you a
26 date when you should have these estimates to them, I
27 understand from that, or do you know that?

28 A To the best of my know-
29 ledge they have not, but I'm not aware of it if they
30 have.

Faulkner & Serra
Cross-Exam by Bayly

1 Q Would you be asking them
2 for that information?

3 A I anticipate that that
4 will be one of the points that we will come to grips
5 with here fairly soon, not only Shell but all of the
6 users of that system, yes sir.

7 Q And have you contemplated
8 the possible necessity of you running your own trans-
9 portation system if the existing carriers cannot
10 handle yours and the other additional loads that these
11 related projects would put on their facilities?

12 A No sir, we have not.

13 Q That means that you
14 haven't planned for it, or you don't plan for it?

15 A We haven't planned for
16 it, and speaking on my own at the moment, I don't
17 anticipate that that's a business that we particularly
18 would want to get into.

19 Q Now, the lead time for
20 the construction of barges is something that will con-
21 cern the common carrier, and if I were to suggest to
22 you that that time may be as much as two years, would
23 you be able to comment on that?

24 A I guess that that lead
25 time does not particularly surprise me, if that is
26 the number you have gleaned from somewhere. I think
27 that that depends on a lot of things, though -- market
28 conditions as far as construction yards at the time,
29 and the type of the barge, and a number of other factors.

30 Q All I'm suggesting to you,

Faulkner & Serra
Cross-Exam by Bayly

1 Mr. Faulkner, is that you may arrive at Hay River with
2 a load of material and no barge to put it on, and that
3 may affect your schedules.

4 A It would definitely
5 affect our schedules, Mr. Bayly. ^{But} I think that there are
6 other factors regarding the, you know, the decision to
7 go ahead on this project that will affect the decision
8 more than whether or not barges are available.

9 Q All right. The other
10 problem, though, that arises is that the barges may
11 be available but they may take your equipment rather
12 than say the community supplies in the seasons in which
13 you want to do your barging, and that may be a spin-
14 off impact of your failure to come to grips with these
15 logistics in time. Have you considered that as a
16 possible impact of the project?

17 A I understand what you're
18 saying, Mr. Bayly. We have not done any definitive
19 work that would allow me to answer that one in any
20 way, shape or form. I am sorry.

21 Q All right, when you say
22 "we" do you speak for the company or do you mean "we"
23 as this panel?

24 A I intended the "we"
25 as my company and I think that --

26 Q I see you're getting a
27 nod from the man next to Mr. Ballem here.

28 A Yes sir.

29 THE COMMISSIONER: That's a
30 good sign.

Haulkner & Serra
Cross-Exam by Bayly

MR. BAYLY: Let's turn then to the composition of your gas finds and that is found both in Table 4 -- sorry, Table 1 and page 4 of your evidence. Table 1, if I can find it here, and the figures, Mr. Commissioner, in the thin yellow volume.

THE COMMISSIONER: Yes, I have it. I have it, I was just glancing through this other one while waiting for you to carry on.

MR. BAYLY: Q Table 1 gives a composition of the gas that has been found presently in the Niglintgak site, is that correct?

A That's correct.

Q And I invite you to agree with me, as I did with Mr. Mainland, that it may be that in future finds in the delta that the hydrocarbons discovered will have sulphur compounds in them.

A We think that that is unlikely but I guess we could certainly concede that that is a possibility. John, you may wish to comment a little further on that.

WITNESS SERRA: Yes, basically our belief in this regard is that most sandstone reservoirs tend not to have sulphur components associated with them. The occurrence of sulphur components is more usually found in carbonate reservoirs and so we would think there would be a low possibility of encountering sulphur in our sandstone reservoirs in the delta.

Q So that's a low possibility

Faulkner & Serra
Cross-Exam by Bayly

1 but it is still a possibility, given the state of
2 knowledge of the Mackenzie Basin at present.

3 A Yes, but the data to date
4 would indicate that it's not likely because we have
5 not yet -- we've analyzed -- our company has analyzed
6 in excess of 50 samples from our own wells, plus the
7 additional data available within the rest of the
8 industry, ^{and} to date there's been no sulphur components
9 found in any of the gas.

10 Q All right. Now that
11 is when you're talking about gas, do you include that
12 forecast for hydrocarbon finds in general in the
13 Mackenzie Basin? In other words, those finds that you
14 may have where gas and oil are in the same reservoir,
15 or are you not so certain of those?

16 A We have not found any
17 H₂S in association with any of the oil, no.

18 Q Now, where would you
19 place that possibility?

20 A Probably in a similar
21 realm as the other.

22 Q All right, and is that
23 because of the limestone formation?

24 A Yes, it would be.

25 Q What is the position of
26 your company -- and perhaps you can't answer this --
27 but do you know the position of your company with
28 regard to what they will do if they find gas or gas
29 and oil combined in which there is a high content of
30 sulphur compounds?

Faulkner & Serra
Cross-Exam by Bayly

1 A Well, our company has
2 many gas streams with sulphur components in them, and
3 we handle them in the manner that is necessary to
4 handle the gas.

5 WITNESS FAULKNER: Could you
6 define what you mean by "the company position"?

7 Q Well, what my concern
8 is is that we have a project beginning in which the
9 initial gas supplies that have been located and are
10 proposed for production are sweet gas. The concern is
11 that some future gas finds may well be sour gas and
12 will have to be processed in this area. That may have
13 certain impact, and I want to know if the company has
14 decided either to process them in certain ways or
15 not to process them at all but to leave them?

16 A I think it's fair to
17 say, Mr. Bayly, that our company certainly isn't going
18 to walk away from a gas or oil find just because there
19 is H₂S connected with it. There are proven methods
20 that allow one to safely process and handle both sour
21 oil and gas streams. It certainly requires a much more
22 complex and costly treating process, and you know, if
23 really the sulphur content of a reservoir gets so high
24 that the benefits to be accrued from stripping that
25 gas stream of the usable products get to be questionable,
26 then there's probably some economic limit beyond which
27 you turn your backs on it; but not necessarily because
28 of -- or let me rephrase that, and go back to my
29 initial statement. I think that if we find either
30 sour gas or sour oil pools in the region, that look

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Cross-Exam by Bayly

1 to contain economically -- economic quantities of oil
2 or gas that it would be our intention to proceed with
3 development plans and hope to gain approval for such
4 plans.

5 Q Now, could we turn from
6 that to the question of toxic substances that may be
7 involved in your drilling operations, or in your pro-
8 cessing operations, and do you agree with the statements
9 that you've listened to from Mr. Mainland yesterday
10 that sumps will contain compounds which may be toxic
11 to plants and animals, particularly if they're allowed
12 to escape into aquatic habitat?

13 A There's no doubt in my
14 mind that the sumps, drilling sumps will likely con-
15 tain solutions that are toxic. Once they are released
16 to streams or the land surface, I think a lot depends
17 very much on the degree of dilution that occurs on
18 the release. But there's no doubt, I think, that if
19 one dropped fish into a drilling sump that they would
20 not last very long.

21 Q Now, you've referred in
22 your thick yellow volume at page 2-25.2.4.5.1.4 under
23 "drilling fluid sump" to the fact that considerable
24 research has been carried out with regard to making
25 sumps impermeable and to disposal of sump fluids and
26 retirement of sumps after use. Now, we had a review
27 yesterday from Mr. Mainland of steps that his company
28 has taken in research with regard to ensuring that
29 the sump walls will be impermeable. What solutions
30 have you found to the problems of leaking sumps?

Faulkner & Serra
Cross-Exam by Bayly

1 A Sir, I think that the
2 solutions that Mr. Mainland addressed himself to yes-
3 terday by and large spoke of industry efforts at
4 improving the nature of the drilling of sumps that
5 are being used, and I think that by and large his
6 comments would pertain to the sort of work that we've
7 been involved in as well.

8 Q Have you made any plans
9 then as to whether you would create a soil cement
10 wall which would also be frozen, or whether you would
11 combine a frozen dyke with some sort of a plastic
12 liner?

13 A We have not made that
14 final decision, Mr. Bayly. I think that either method
15 that you've described is plausible, but we're not
16 prepared to say at this time that we're going one
17 route as opposed to the other.

18 Q And with regard to the
19 options, will you be testing those out in the field
20 to determine which one would be the more suitable for
21 the facility that you have planned for Niglintgak?

22 A Sir, we have no definite
23 plans at this point in time to test our final design
24 I think prior to going into the development phase,
25 unless our exploration drilling operation is, you know,
26 continues, and we are able to make these tests on that
27 program. I can say at this point in time that the
28 sumps that we are constructing for use during our
29 exploration drilling operations are evolving, and
30 certainly I would anticipate that construction of these

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Cross-Exam by Bayly

1 particular sumps will make use of some of the techniques
2 that we would plan to use later on, but I can't point
3 you to a definite test program that we are planning
4 to conduct in that regard.

5 Q Well, given the schedule
6 that you have projected, can we expect the sump to go
7 in prior to field testing, and that this will be the
8 great experiment?

9 A No sir. I don't think
10 that's fair to say at all. I think that the techniques
11 that we will use in our development drilling program
12 will be techniques that we have evolved during our
13 exploration drilling program, or that other people
14 working in the area have tried and proven, and I
15 think it fair to say that we won't be using any radi-
16 cal new technology in building sumps that we plan to
17 use in our development drilling program.

18 Q With regard to sumps
19 and keeping flood waters out, your project is very
20 close to a river channel and not very far from the
21 Beaufort Sea, and perhaps therefore subject to storm
22 surges. Would you agree with that?

23 A Yes sir.

24 Q And being so close to
25 the Kumak Channel you must have had to design the
26 height of the walls of your sump to an adequate height
27 to ensure that you don't find your sump fluids washed
28 away either in a flood or a storm?

29 A Yes.

30 Q Is that correct?

Paulkner & Serra
Cross-Exam by Bayly

1 A That will be one of the
2 main criteria, yes sir.

3 Q O.K., let's have a look
4 on the last page of your thick yellow book, figure 5,
5 and can you tell me with regard to Section A-A or A-
6 prime whether this diagram is schematic or whether we
7 should assume from it that your wall of your sump is
8 going to be higher than your rig platform?

9 A Well, I think first off
10 there's no question, but what you should consider it
11 as being schematic. I'm afraid this relates to our
12 exploratory drilling operation. I am not as familiar
13 as I might be on that subject, Mr. Bayly. If you
14 care to expound on that question, I may be able to
15 help you, but I think if not we can get whatever
16 answers you're after on this one.

17 Q Well, let's go a little
18 farther on it. We've got a big dyke on the right-hand
19 side, and then a rig platform. Would you anticipate a
20 dyke on the other side of the rig platform to protect
21 it from flood waters as well and to protect the mater-
22 ials in the sump from escaping?

23 A I believe that it is the
24 practice at this time that the entire drilling area
25 be enclosed by a gravel dyke, yes sir.

26 Q All right, and you said
27 a gravel dyke, following up the questions Mr. Scott
28 asked yesterday of Mr. Mainland, would you anticipate
29 armoring the banks of that dyke with something more
30 substantial than gravel, with some form of riprap

Faulkner & Serra
Cross-Exam by Bayly

1 material?

2 A I wouldn't anticipate
3 it, sir, but I'm not sure what is done. To the best
4 of my knowledge, though, we do not armor that exterior
5 dyke particularly, no.

6 Q Can you tell me whether
7 you would anticipate -- oh, is there another answer?

8 A No sir.

9 Q Can you tell me whether
10 you would anticipate placing a dyke around the plant
11 as well as around this part of the operation, that is the
12 drilling pads?

13 A Yes sir, I think for
14 very much the same reasons that were discussed yester-
15 day, minimization of some of the fills and gaining
16 protection from flood and storm surge waters we certainly
17 would intend to dyke at least portions of that central
18 pad that we would build the gas processing facility
19 on.

20 Q All right, would you
21 anticipate that it would be at a similar elevation in
22 comparison to the dyke as the rig platform is, as
23 shown here? That it would be lower, in other words,
24 than the surrounding dyke?

25 A I'm afraid I've missed
26 your point here, Mr. Bayly. Would it be lower than
27 what?

28 Q Would the cross-section
29 of the plant site configuration be similar to that
30 of the rig platform, would we find the base of it at

1 a similar elevation in comparison to the dyke as we
4 have in this diagram? Perhaps you don't know that.

3 A Oh, no, if I understand
4 you properly, the way we are conducting our exploration
5 drilling program is that we are using very little
6 granular construction material, over the surface
7 vegetation. Now if that's the elevation you're
8 talking about here, the surface elevation, in our
9 drilling operation it's essentially the difference
10 between the natural ground surface and the top of
11 any dyke that's there. On our plant site, no, that
12 certainly isn't our intention. We anticipate that
13 we will have granular fill inside a dyked enclosure.

14 Q All right.

15 A Does that answer your
16 question?

17 Q I think I understand
18 that but there is one point of confusion still, and
19 can you explain why, as stated on page 12 of your
20 thin yellow book, your evidence, why the plant
21 buildings would be on piles not only to prevent
22 thermal degradation, but to provide elevation above
23 flood levels? That seems to imply that the dyke
24 around the plant could let in flood waters, and that
25 that would be an anticipated part of the design.

26 A That may be poorly
27 phrased, Mr. Bayly. The prime reason for raising
28 the plant will be to give us the -- well, to founding
29 the plant on piles will be to give us the necessary
30 structural support to hold it up in the air. That

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1 pile cut-off elevation is probably a somewhat arbitrary
2 sort of thing, but I think it's certainly
3 intention that the dykes could be breached for any
4 purpose like that, and I think it may be wrong to
5 infer, as we have done here, that the plants will sit
6 up that high, that they will, you know, be completely
7 above dyke elevation as well.

8 Q Well, would you antici-
9 pate there being any sumps in the vicinity of the
10 plants, as opposed to the vicinity of the wells?

11 A There will undoubtedly
12 be a sump of some sort for in-ponding of surface waters
13 that are caught on the plant pad itself, but we would
14 anticipate that most of this sort of thing would be
15 rainfall or snow melt or whatever; but as on any
16 site there is possibility of you know, minor spills
17 of motor oil, most anything, and it's our intention in
18 the plant design that we would trap that sort of
19 escapement and filter it before that surface catchment
20 would be discharged to a stream or whatever disposal
21 system we intend to use.

22 Q So it may be as much a
23 question of walling in as walling out, for different
24 reasons.

25 A Certainly the dyke will
26 accomplish both purposes, we hope.

27 Q Now, if I -- if you
28 accept for a moment that there is a possibility that
29 the rig platform could be flooded. Have you thought of
30 and proposed contingency plans to control release and

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Cross-Exam by Bayly

1 spread of toxic chemicals?

2 A Sir, contingency plans
3 are filed for various drilling locations now, and
4 certainly we would anticipate that the contingency
5 plans would be further developed before the time we
6 go in and do our development drilling, yes.

7 Q Now, I haven't missed
8 anything in either of these volumes, I take it, it's
9 not there.

10 A The contingency plans?

11 Q That's right.

12 A No, we have not given
13 any specific detailed contingency plan here. We have
14 made reference, I think, in several cases, that such
15 plans will be prepared and while we've addressed such
16 other things as environmental training being done too
17 before we get into our development phase.

18 Q Well, Mr. Commis-
19 sioner, if those plans are available prior to the end
20 of this Inquiry, we would certainly like to have the
21 benefit of seeing them so that we could determine
22 whether they appear to us to be adequate, and I wonder
23 if Mr. Ballem or the gentleman beside him could
24 respond to that.

25 A Mr. Bayly, I
26 think what we are saying here is that the contingency
27 plans that are available are contingency plans for
28 exploration wells, and that is what you're requesting.
29 Correct?

30 Q I was interested

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Cross-Exam by Bayly

1 because at the moment we're discussing the production
2 wells for contingency plans on those. I understand
3 from what you say that as you apply for permits to
4 drill exploration wells that you must provide contingency
5 plans to the government.

6 A Yes sir.

7 Q Now we haven't got to that
8 stage with the production systems yet, but I assume
9 that before you do get to that stage that you will be
10 developing contingency plans.

11 A Yes sir, and I think
12 we will be developing --

13 Q I'm asking that if those
14 are available prior to the finish of this Inquiry,
15 that we have the benefit of seeing them because the
16 contingency plans may be very important in assessing
17 the possible impact of your project. I see a nod
18 again from --

19 MR. BALLEM: I think that if
20 the answer is that if these plans are available by
21 that time we will be happy to make them available.

22 MR. BAYLY: Thank you.

23 Q Now, Mr. Serra, you're
24 a reservoir engineer and I'm wondering if you or anybody
25 in your department of the Shell Company have considered
26 the possibility of basin subsidance in the Niglintgak
27 structure from which gas will be taken?

28 WITNESS SERRA: Shell Canada
29 per se doesn't have any experience in any fields where
subsidance is a major problem. However, the Royal

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1 Dutch Shell group, to which we are affiliated, has some
2 25 years of experience in dealing with both laboratory
3 predictions and field measurements of the effects of
4 subsidance and compaction, and we have reviewed with
5 them the Niglintgak situation in detail and it's their
6 considered opinion that subsidance will not a problem.

7 Q Now when you say it won't
8 be a problem, does that mean that it won't occur?

9 A Some subsidance will
10 occur, but it will be in orders of magnitude that are
11 very small and not of any particular consequence.

12 Q Well, what orders of
13 magnitude can be tolerated in this area which is vir-
14 tually within the flood plain of a large river?

15 A I haven't addressed myself
16 to what can be tolerated. Our estimates are approximately
17 one foot over a 30-year period.

18 Q All right,

19 THE COMMISSIONER: Is that
20 your estimate of what will occur by way of subsidance?

21 A That's our estimate of
22 what could occur.

23 WITNESS FAULKNER: Our estimate
24 of the maximum that could occur,

25 WITNESS SERRA: That's correct.
MR. BAYLY: Q Well, if you

26 should find that subsidance is occurring, either the
27 one foot that you project or more because of something
28 unforeseen, either in the gas that you intend to take
29 out to begin with or any that you intend to take out
30 adjacent to this development, or just in this area, can

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Cross-Exam by Bayly

1 you control it? Can you inject stuff back into the
2 ground and stop it?

3 A Yes, the rate of sub-
4 sidance of course, will be very slow and we will be
5 able to visually observe it, and take the necessary
6 action, as you've suggested, one technique might be to
7 inject some water or something like this to offset it,
8 that's correct.

9 Q Does that solve the
10 subsidence problem, or does it just control the rate
11 of it?

12 A It offsets it, sir.

13 Q Completely?

14 A It would depend on how
15 much you inject and how much you withdraw.

16 Q There are basins, I under-
17 stand, one being near Santa Barbara, California, where
18 there's been a dramatic subsidence and were efforts
19 to your knowledge taken to control that?

20 A I believe that there
21 wasn't at the time, sir.

22 Q And you can't do it
23 afterwards, you have to be prepared to do it as it's
24 happening; is that what you're telling me?

25 A That's correct.

26 Q Now is that opinion that
27 you've expressed restricted to the structure at
28 Niglintgak or are we talking about a general statement
29 about the ability to control subsidence in the Mackenzie
30 Basin?

Faulkner & Serra
Cross-Exam by Bayly

1 A Well, my statement was
2 with respect to Niglintgak structure, but I think it
3 would have equal application anywhere. You have
4 study each reservoir on its own, it's properties.
5 I expect that the Taglu situation might not be as
6 serious as Niglintgak or as great as Niglintgak.

7 Q And is that because it's
8 a deeper find of hydrocarbons?

9 A Yes, that would be true.

10 Q So the shallower the find,
11 in general terms, the more subsidence you can expect
12 to have to control?

13 A It's not directly related
14 to the depth, sir, it's more related to the compaction
15 or the consolidation of the sand materials.

16 Q But that, I gather, is
17 related to depth because of the pressure.

18 A That's correct.

19 Q Now, in your evidence and
20 perhaps I could go back to Mr. Faulkner now, at page
21 5, near the bottom of the page,

22 "Shell believes that the gas reserves that
23 can be drained from wells located north of
24 the Kumak Channel will be sufficient to
25 support the proposed Niglintgak plant if the
26 river crossing does not prove to be physically
or economically viable."

Now, you've proposed a well on the other side of the
channel.

WITNESS FAULKNER: Yes sir.

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Cross-Exam by Bayly

1 Q But you don't know whether
2 you'll be able to cross the river overhead or under the
3 river bed, is that correct?

4 A That is correct, yes sir.

5 Q Now, if you can't cross
6 the river, how do you get the gas to the gas plant, or
7 do you build another gas plant?

8 A I think that what we are
9 saying here, Mr. Bayly, is that if this plant goes
10 ahead in isolation and if we through later engineering
11 analyses, determine that for some reason we don't think
12 it's practical to bring that gas to this plant, that
13 it will stay there until there is -- until, if ever,
14 there is some other means of processing it. I suppose
15 there is always a chance of another plant, but maybe
16 I could just bring up another point here.

17 THE COMMISSIONER: Excuse me.
18 Would you mind just repeating that thought? I didn't
19 quite follow it.

20 A I think what we are saying
21 here is that at this point in time we do not see another
22 plant in the area to which gas from this particular
23 well could logically be taken, and therefore we would
24 see that gas remaining in the ground if we could not
25 get it to the Niglintgak plant for processing.

26 Q Across the --

27 A Across this Kumak River
28 channel, yes.

29 THE COMMISSIONER: Right, I
understand.

Faulkner & Serra
C ross-Exam by Bayly

1 MR. BAYLY: Well do you contem-
2 plate in the life of the reservoir other production
3 wells on the south side of the channel?

4 A In this Niglintgak
5 accumulation? No. As we understand it now, one well
6 on that side of the river should be capable of draining
7 the reserve that is located there, if it can't
8 be tapped from north of the river, and we see no
9 other extension of this reservoir beyond that.

10 Q Is that forecast based on
11 the reservoir at this depth, or have you determined
12 from drilling that -- whether there's gas beneath this
13 particular deposit that you might go after next?

14 A Maybe you better --

15 WITNESS SERRA: We haven't
16 drilled wells across that river channel yet so it's
17 not predicated on the draining reserves from deeper
18 zones, but with deeper zones you have the flexibility
19 of using a similar concept to what Imperial is using
20 in their clusters in that you can have your surface
21 location at a remote area from your down-hole formation.
22 You don't have that flexibility with a shallow zone
23 in a shallow reservoir, so it's only a shallow
24 reservoir that is of concern here.

2 Q And you feel that you
3 sufficiently determined the extent of the shallow
4 reservoir to be able to tell us that you wouldn't be
5 having any more production wells than you have put
6 on your plan for this initial stage of development.

A That would be the indi-
cation at this time, that's correct.

1 Q O.K. The indication at
2 this time doesn't necessarily mean, as I understand
3 Mr. Horsfield's evidence, that the field won't be
4 better defined after it goes into production. Is that
5 fair to say?

6 A Certainly the field will
7 be better defined as we get more information about it,
8 correct.

9 Q I don't want to stick you
10 with something that you can't live with. I just want
11 to know whether you're saying that you can or can't
12 guarantee that there won't be more production wells
13 to tap this reservoir.

14 A Well, I can't guarantee
15 anything relative to future events, but I can give you
16 my best estimate of what I think is going to happen,
17 and my best judgment at this point in time is that
18 there would be no wells required other than the one
19 across the river channel.

20 Q Well, given that that
21 best estimate turns out to be after exploration and
22 development in fact the proper forecast, if this well
23 on the south side of the Kumak Channel was to be
24 developed and the gas was to be processed, and you
25 couldn't cross the channel, then it would have to be
26 fed by a feeder line, I assume, to some other process-
27 ing plant. Would that be fair to say?

28 WITNESS FAULKNER: If it were
29 to be developed and these other things that you
30 postulate come to pass, yes.

Faulkner & Serra
Cross-Exam by Bayly

1 Q Now, I didn't postulate
2 those, I found those in your evidence.

3 A No, you postulated. You
4 made the assumption that we won't be able to cross the
5 river with the gathering lines.

6 Q All right, well I find
7 that in your evidence on page 5 that you say that it
8 may be that you can't.

9 A Yes, but I took that you
10 were saying it's --

11 Q Well, let's take that
12 as a scenario anyway. Pardon me, Mr. Ballem, for using
13 that word.

14 MR. BALLEM: I'm thinking of
15 bringing an infringement action as a matter of fact.

16 THE COMMISSIONER: Well, before
17 the witness answers, could I just have the scenario
18 again?

19 MR. BALLEM: I'll select my
20 defendants rather carefully.

21 MR. BAYLY: Q The possible
22 forecast, Mr. Commissioner, is -- and again I'm taking
23 this possibility largely from the evidence that Mr.
24 Faulkner has led. There is a possibility that the
25 river crossing will either be physically or economically
26 --

27 THE COMMISSIONER: Out of the
28 question.

29 MR. BAYLY: -- out of the
30 question, right. If that is the case, then there is

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Cross-Exam by Bayly

1 gas on the south side of the channel and if it is to
2 be exploited and processed what I'm asking is whether
3 it will have to go to another plant by way of feeder
4 line, or whether a processing plant would be set up?

5 THE COMMISSIONER: Well, at
6 the south side of this, looking at this, now where is
7 the south?

8 A North is to the top on
9 that diagram.

10 Q All right, but the
11 channel appears to go north-south and not --

12 A Well --

13 MR. BAYLY: You could call it
14 south-east instead of east.

15 THE COMMISSIONER:
16 Right, right, I'm with
17 you.

18 Now let's
19 do that again then.

20 MR. BAYLY: I'm asking Mr.
21 Faulkner, Mr. Commissioner, if the gas well, the
22 production well is developed on the south side of
23 this channel and it doesn't make any sense or physically
24 can't be done to cross this channel, where will this
25 gas be processed?

26 THE COMMISSIONER: Right.
27 If at all.

28 A If at all, I think, is
29 the question. All right, I guess there are several
30 possibilities and some of them could be the location
31 of compression in the vicinity of the well or wells

Faulkner & Serra
Cross-Exam by Bayly

1 that will be drilled there, and transporting that gas
2 to another gas plant, for instance Imperial's
3 Taglu plant we talked about yesterday; there is the
4 possibility, I suppose, of building a small separate
5 plant in the vicinity of the accumulation itself that
6 could then be tapped into the sales gas pipeline and
7 deliver pipeline quality gas there. I think both of
8 those possibilities are very slim possibilities because
9 of, if nothing else, the economics involved. The
10 amount of gas that we see ^{that} is likely to be in that
11 area now couldn't support the capital cost of developing
12 either of those two options, but they are possibilities.

13 MR. BAYLY: Q Would you say that
14 it's out of the question to run a feeder line up the
15 right-hand side of that channel and take advantage of
16 the pipeline crossing construction to bring your
17 feeder line to the gas plant?

18 A Not impossible at all,
19 and I think that was going to be my next point. That
20 what we have shown on this map is a tentative spot
21 where we -- where it would be most advantageous, I
22 think, for us to cross the river, but there have been
23 problems identified with it. We certainly have not
24 yet ruled out the possibility that you have suggested,
25 that there might be better places to cross for a
26 particular line. Seeing as how we're speculating now,
27 I'd like to introduce another one, that there's also
28 the possibility that we might be able to produce gas
29 from accumulations - - well, this accumulation south
30 of the river on a seasonal basis by stringing some sort

Faulkner & Serra
Cross-Exam by Bayly

1 of above-ground gathering line across the river channel
2 ice in the winter months and producing that accumulation
3 only in the winter.

4 Q All right.

5 A Does that satisfy the
6 questions you posed, Mr. Bayly?

7 Q I think so. There may
8 be more but those are the possibilities you can think
9 of at present?

10 A Yes sir. That's correct.

11 Q The difference between the
12 Shell proposal and the Gulf and Imperial proposals at
13 this time are that Gulf and Imperial, because of the
14 structures and because of the depth of the finds are
15 able to drill from cluster pads and Shell is not. Would
16 that be fair to say?

17 A Yes sir, that's one of
18 the differences.

19 Q And because of that it
20 means that you must rely on feeder lines from produc-
21 tion wells on individual pads to bring the gas to the
22 gas plant.

23 A That is correct, but I
24 don't think that is a difference. The Gulf proposal,
25 for instance, relies on feeder lines to carry gas to
26 the plant.

27 Q It's not a difference
28 but in terms of length of feeder lines there is some
29 difference in the way it will look.

30 A Yes sir.

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Cross-Exam by Bayly

1 Q There may be some
2 differences in the potential effect that it may have
3 on the environment.

4 A Yes sir.

5 Q I'm not saying that that's
6 your fault.

7 A No, no, I'm sorry, I
8 thought that you were postulating that as a difference
9 between ours and Gulf and Imperial's projects, and I
10 don't see it as a difference.

11 Q Now, looking at this
12 and comparing it with gasfields that have been, or hydro-
13 carbon fields that have been developed in the provinces
14 and in Shell's experience around the world, this is a
15 very small system of wells and feeder lines. Would
16 you agree?

17 A Well, I wouldn't call it
18 small, but it's much smaller than many fields that have
19 been developed, yes.

20 THE COMMISSIONER: Well, there's
21 a difference here, isn't there? Are you / talking about the
22 volumes of gas that will be produced there, or are you
23 talking about the extent of the facilities, or both?

24 A I may have been mixing
25 up the two, Mr. Commissioner. I guess in terms of the
26 design throughput of this it is far from what we would
27 term a small gas operation. In aerial extent, yes, I
28 think you're right, it ranks in a small designation.

29 MR. BAYLY: Q And in terms of
30 the number of wells predicted, and therefore the amount

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Cross-Exam by Bayly

1 of feeder line mileage required, it is also small.

2 A Yes sir.

3 Q That may have nothing to
4 do with the size of the deposit, I'm just talking about
5 the physical things that you have to build in order to
6 get the gas out.

7 A Yes sir, that's a fair
8 statement.

9 Q Because as I understand
10 you could have a formation that would allow you to take
11 all the gas out of a formation with a single well.

12 A Yes sir.

13 Q It's rare but it does
14 happen. Now, I'm looking at other possibilities that
15 you have in the delta; would you say that there are
16 areas that may require a large number of wells and
17 feeder lines in order that they be developed, that the
18 gas be processed? For example, if you went up onto
19 Richards Island or if you went west of the present
20 proposals and holdings that Shell has in that area.

21 A Well, as you know, Mr.
22 Bayly, we haven't been overly successful at finding
23 other accumulations, but I think where we have other
24 prospects we don't really anticipate that they will be
25 normally as shallow as this, so I'm afraid I just don't
26 know how to answer that question. I can concede it's
27 a possibility. I don't know how to give you any
28 meaningful answer to that.

29 Q Well, here's the concern
30 that's been expressed by people in this area, Mr.

Faulkner & Serra
Cross-Exam by Bayly

1 Faulkner. What is it all going to look like in 20
2 years? So far we haven't been able to find anybody
3 that can tell us, and I appreciate because of the kind
4 of evidence that Mr. Horsfield gave us that development
5 is an evolutionary or step by step process; but will
6 you go so far as to say there's a possibility that
7 they may -- there may be areas in the delta that will
8 look say, like the Swan Hills oil and gas field?

9 A Look like the Swan Hills
10 oil and gas field in what sense?

11 Q I'm thinking of from the
12 point of view of a moderately large area with wells
13 spaced fairly far apart and feeder lines inter-con-
14 nected. I have an aerial photograph here you can have
15 a look at in a Forestry Report -- I'll give this
16 to your counsel, and I just invite you either to agree
17 or disagree that there is a possibility that gas fields
18 may be developed in this area that look quite similar
19 to this from the air. I have another copy of this,
20 Mr. Commissioner, if you wish to look at it.

21 THE COMMISSIONER: Thanks.

22 MR. BAYLY: I'm not concerned
23 with the article that surrounds that; I'm just con-
24 cerned with the photograph which shows from the air
25 a hydrocarbon development which I believe has oil and
26 gas in it and has a large number of feeder lines and
27 wells.

28 A Yes sir. You don't happen
29 to know what the scale of this photograph is, do you?

30 Q No, I don't.

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Cross-Exam by Bayly

1 A I think a few general
2 comments are in order, and I'm not sure that I can
3 give you much more than that; but no, I don't think that
4 we anticipate that you would have oil or gas fields
5 developed here with this degree of array of gas --
6 different well locations and different flow lines and
7 road systems and that sort of thing, because I would
8 anticipate that the clustering concept that was addressed
9 yesterday would come into play and would certainly
10 minimize the number of surface locations which would be
11 required. In so minimizing the number of surface
12 locations, the number of roads would then also be
13 reduced. I think that's basically what we're looking at
14 here, is a network of wells and the roads that link
15 them up, and I guess there are some pipeline corridors
16 there, although they're not very obvious. But I think
17 generally no, I think regardless of what scale this
18 map is on, I think we would anticipate that a similar
19 sized oil accumulation, or gas accumulation up here
20 would be drained from fewer surface locations and that
21 there would be a much less extensive road and pipeline
22 system linking up these locations.

23 MR. BAYLY: Mr. Commissioner,
24 perhaps that could be marked as an exhibit just for the
25 purposes of information for the record.

26 THE COMMISSIONER: All right.
27 (FORESTRY REPORT, VOLUME 4, MARKED EXHIBIT 426)

28 MR. BAYLY: Mr. Commissioner,
29 I'm about to turn to another subject and if it's time
30 for coffee, this would be appropriate for me.

Faulkner & Serra
Cross-Exam by Bayly

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THE COMMISSIONER: By all

means.

(WITNESSES ASIDE)

(PROCEEDINGS ADJOURNED FOR A FEW MINUTES)

B. Stewart
Cross-Exam by Commissioner

(PROCEEDINGS RESUMED PURSANT TO ADJOURNMENT)

BARRY DEANE STEWART, resumed

THE COMMISSIONER: Mr. Stewart --

A Yes, sir.

THE COMMISSIONER: I referred
you^{to} the evidence given by Mr. Blair of Foothills on
August 9 of Norman Wells when he struggled valiantly
to make it clear to the people of the community what
this whole question of reserves is all about and he
said -- this was evidence he gave in August. He said
"the independent consultant that has estimated the
reserves for us has come up with a figure of about 7.2
trillion cubic feet." Then he went on and he said "the
latest public statement by the Canadian Petroleum
Association was 8.5 trillion cubic feet," now that --
you gave us the estimated reserves that Imperial has
at Taglu. We've heard what Shell's estimated reserve
is at Niglintgak and we'll no doubt hear from Gulf
later today. But do you -- is that figure of Mr. Blair's
one that you would agree with.

A I could guess my simple
answer would be no, but I would have to go on and
explain that in some detail and perhaps it would be
appropriate to do that.

Q Yes.

A I think when we talk
reserves, we always have the chronic problem of
terminology or technical jargon, if you will, on just
what kind of reserves we are talking about. There

B. Stewart
Cross-Exam by Commissioner

1 have been a number of different methods used to
2 estimate and to quantify the reserves and the un-
3 certainty in that number. And, I guess the traditional
4 approach has been to use labels "proved," "probable" and
5 "possible" and these labels bring up the connotation of
6 different degrees of certainty or uncertainty in the
7 numbers. The 7.2 figure that I believe Mr. Blair was
8 referring to came out of consultant work. I believe
9 the firm was JLJ Exploration Consultants, and that
10 number to my best recollection would be a possible
11 reserve number in the discoveries to date at the time
12 they did the work. And, they had different degrees of
13 information on the different fields which have been
14 discovered. I believe in the testimony before the
15 National Energy Board last December it became quite
16 clear that they did not have very much information on
17 our ADGO discovery for example. And that I think they
18 acknowledged that upon receipt of more detailed inform-
19 ation which we, the producers, are now providing them,
20 they will probably revise their figure on the ADGO
21 field. They've been carrying a number in the order of
22 I believe 1.5 TCF whereas others number including the
23 Imperial number are below 200 BCF. So it's a rather
24 significant reduction in that one case. So I guess,
25 that explains why I would suggest the 7.2 number even
26 in the eyes of the Foothills consultants may be too
27 high for this possible number at this point in time.
28 The --

29 Q Well, what number would
30 you --

11
B. Stewart
Cross-Exam by Commissioner

1 A Well, I guess the point
2 is that there's probably been three different sources
3 of figures to this point. One has been the study
4 Mr. Blair was referring to. There has been the Sproule
5 Associates study which was done for Arctic Gas and
6 these were the numbers Mr. Horsfield referred to in
7 his opening statement. And I believe they quoted a
8 number 4.7 trillion feet as proved as probable, which
9 is the number I prefer to quote as the best estimate
10 perhaps. There's a possible number 6.5 in that study.
11 The other source of you have mentioned is the three
12 producers themselves who have independently assessed
13 their own individual finds. When we take the probable
14 number -- that includes crude in my terminology from
15 the Gulf and the Shell numbers, this is what I would
16 guess is their most likely occurrence under the assessment
17 techniques they use and add it to the likely number
18 that we have from our method which is different. It
19 is a method of probability assessment. We come up
20 with a number I believe slightly over 5 trillion feet
21 as the proved, plus probable in their terminology, or
22 likely in ours. And I think I would tend to use that
23 type of number in the order of 5 trillion feet as the
24 likely established reserves at this point in the Beaufort
25 Delta.

26 Q That's the figure you would
27 substitute for Mr. Blair's 7.2--

28 A Well, I had some difficulty
29 with the label that was being put on the 7.2 in that
transcript. They seem to be calling it probable in

B. Stewart
Cross-Exam by Commissioner

1 some cases and other terms. I think it should have
2 been a possible label and I would think if we are
3 talking in terms of possible numbers we would come
4 down to something in the order of the Sproule number
5 which would be 6.5 let's say. And much of that
6 difference is probably attributable to that ADGO
7 difference that has surfaced since the Foothills
8 consultants did their work. So, if we are talking
9 possible numbers --

10 Q But the information on
11 ADGO results in a downward--

12 A Yes, sir. The detailed
13 analysis of ADGO has shown a highly faulted formation
14 and therefore the accumulation is a small portion of
15 the total structure and they had assigned gas reserves
16 to the total structure, based on very preliminary
17 information. Whereas we, as the operator with the
18 detailed well control and seismic information were
19 able to quote I think a perhaps more reliable number
20 and that has been put before the Energy Board. This
21 material has now been provided to the Foothills cons-
22 ultants and they are on the record of looking at it
23 and going to revise their number but they haven't
24 suggested what it would be.

25 Q Well -- those are matters
26 for the Energy Board and we can't expect to attempt
27 to sort them out here, but I just wanted your comment
28 on Mr. Blair's testimony. I think he avoided using
29 the expressions like "proven" and "probable"; he was
30 concerned about the amount of gas he would be in a

B. Stewart+
Faulkner & Serra
Cross-Exam by Bayly

position to tell the bankers and the financiers that
he had. That seemed from his point of view to be the
way of -- the best way of classifying the gas.

A Again, you always have
the difficulty with reserve numbers unless you do put
a label to them because there are different degrees of
certainty in different estimates.

THE COMMISSIONER: Yes. Just
this one second before we leave this. Mr. Blair des-
cribed Foothills as a small and scrappy company.
Adopting the underdog position and clinging to it for
all he was worth. Well, that's fine. Thank you very
much sir.

(WITNESS ASIDE)

MR. BAYLY: Mr. Commissioner,
I'm assuming that perhaps Mr. Ballem can answer this --
that on the policy panel there will be somebody from
Shell?

MR. BALLEM: Yes , I can con-
firm that.

MR. BAYLY: That takes care of
one question.

ROBERT ELLIOTT FAULKNER, resumed
JOHN WILLIAM SERRA, resumed

MR. BAYLY: With regard to the
question of gravel, Mr. Faulkner, could I refer you to
your evidence at page 6?

MR. BALLEM: Just before we
get into that area I had the impression and I'm not

Faulkner & Serra
Cross-Exam by Bayly

1 sure that Mr. Faulkner wanted to give you some additional
2 information?

3 A No, we've decided that we
4 have nothing further to say on that point.

5 MR. BAYLY: I'm tempted to ask
6 what it was.

A It was with regards to the
Swan Hills evidence.

9 Q Referring to page 6 of
10 your evidence, you say at the bottom paragraph that
11 Shell anticipates that approximately 8 hundred thousand
12 cubic yards of gravel will be required from the Yaya
13 deposit during construction of the projects. And,
14 that a further 50 thousand cubic yards per year will
15 be required throughout the life of the project for
16 maintenance purposes. And that is per year?

17 A Yes sir.

18 Q And the projected life of
19 the project is 20 years?

20 A In that order, yes sir.

21 Q And that's another million
22 cubic yards of gravel.

23 A That's correct.

24 Q Is that for topping off
25 roads and pads or is this something that might be
26 tied to future production wells and pads underneath
27 them?

A The intention when we
wrote this little summary was that that figure is
for basically maintenance of the pads and roads that

Faulkner & Serra
Cross-Exam by Baylv

1 that were constructed in the first instance. Not for
2 establishing of new roads or pads or any such thing.
3 I think it should be stressed that it's a very prelim-
4 inary estimate and perhaps it's on the high side, perhaps
5 it's on the low side, I honestly don't know at this
6 point in time, but, it represents an effort by us to
7 quantify what we think is not an unreasonable maintenance
8 requirement for a facility such as we are planning.

9 Q And, given the amount of
10 roads and pads and dock sites you've based your
11 projected requirements on Shell's experience in maint-
12 enance of this kind of facility in other places,
13 would you say that?

14 A That -- yes, that is
15 correct. Mind you, we may be conservative in our
16 estimates here in that, I think that the gravel laying
17 operation that we will undertake in the delta will
18 probably much better planned and much better executed
19 than a lot of the -- well for instance road systems
20 such as in the Swan Hills field that you have shown
21 here. I think that there will be a much better design
22 and hopefully much better construction techniques used
23 and maybe the maintenance requirement will be lower.
24 But, yes, that was the information from which this
25 number was generated. A sort of average usage per
26 year in terms of percent of gravel in place that
27 would be required.

28 Q Right. Could you give
29 an opinion then as to whether we could expect from
30 the other projects in the area, whether they're the

Faulkner v. Serra
Cross-Exam by Bayly

1 ones projected now or projected in the future, that
2 given the techniques that the petroleum industry uses
3 that you require a reserve of that percentage of your
4 initial gravel needs for maintenance over the life
5 of the project from year to year?

6 A I would rather not do
7 that. I could certainly make a statement. I am not
8 an earth fill man and I think that any statement that
9 I made in that regard would be sheer speculation and
10 I'm sure that if you want such statement that you
11 could get it from a much better qualified person than
12 I am sir.

13 Q All right. Perhaps, Mr.
14 Commissioner, inquiries could be made to ^{the} Shell earth
15 fill man and we could have that information through
16 Mr. Faulkner's counsel, because I think it's important
17 that we know if maintenance requirements are going to
18 be a percentage of the total likely for each project.
19 You agree that this may have an effect on the planning
20 for the most intelligent use of the gravel in this area?

21 A No doubt about it.

22 Q And you were listening
23 yesterday when it appeared that through the evidence
24 of Mr. Mainland there might be difficulties in obtain-
25 ing the quantities that industry desired for the
26 purposes that they had in mind?

27 A Yes sir. We are well
28 aware of that difficulty.

29 Q I asked Mr. Mainland if
30 he'd thought of the technique that the Russians use

Faulkner & Serra
Cross-Exam by Bayly

1 apparently to build a core out of ice and insulate it
2 and surround it with granular material such as gravel
3 to save on granular materials, and has that been
4 something that Shell has investigated?

5 A Not to any great extent.
6 We are aware of that technique being used and I think
7 that some of the comments that Mr. Mainland put forth
8 when he was discussing the problem yesterday are --
9 would stand as our assessment of the technique as well.
10 It is our understanding that basically this technique
11 is best used where you have a reasonably -- a reasonable
12 soil on which to base such a road and as Mr. Mainland
13 pointed out yesterday, the Taglu area contains an
14 awful lot of ice in those shallow layers. Our proposed
15 development area is of similar terrain and we certainly
16 haven't looked ^{at} this road building technique to any
17 great extent but have kind of dismissed it as being
18 rather impractical.

19 Q Have you thought of
20 building the core out of some other material. Either
21 sand as proposed by Imperial or perhaps even some
22 form of silt?

23 A We have thought about it
24 and I guess that is about as far as can say we have
25 taken it. We have not uncovered any potential sand
26 fill deposits such as the Big Horn Point deposit that
27 was referred to yesterday that would be readily
28 accessible to the Nig site. I think we have identified it
29 in our land tenure application as a point that we
30 intend ^{to} look at a little further but I have no more

Faulkner & Serra
Cross-Exam by Bayly

1 definitive statement than that at this time.

2 Q Are there terrain
3 degradation problems that you see possibly arising
4 as the result of this 50,000 cubic yards of gravel
5 that you would require not being available?

6 A Terrain degradation pro-
7 blems on our project site?

8 Q Yes.

9 A Not of any major sig-
10 nificance.. I think that the sort of thing we are
11 talking about here is more maintenance of the slopes
12 on our various roads and pads and dyking systems where
13 well, where for instance -- due to flood waters, there
14 may have been some slumping in some of our dyke protec-
15 tion or the road slopes or that sort of thing. We
16 don't anticipate that our initial construction would
17 cause depressions that we are then going to have to
18 fill up with this 50,000 yards of material a year.

19 Q When we're talking about
20 significance are you talking about significance for
21 the project, or significance for the terrain? I think
22 you can distinguish between the two. In other words
23 is it possible that the terrain will degrade in such
24 a way that it won't impair the project but may create
25 thermokarst ponding or may create siltation as the
26 result of gravel running off into the channel.

27 A Well, if I -- don't recall
28 just where I used the term "significance" but --

29 Q I think can tell you, if
30 you like.

Faulkner & Serra
Cross-Exam by Bayly

1 A Sorry.

2 Q I can tell you if you like.

3 A All right.

4 Q That you said that you

5 didn't feel that there would be any significant terrain
6 degradation as a result^{of} not having this amount of gravel
7 available. And what my question was, is that significant
8 for the facilities on the project or significant for
9 the terrain?

10 A My concern and my use
11 of "significance" is with the terrain itself and not
12 with the project. I think that as you point out, the--
13 from the project^{point of} view we could tolerate quite a bit of
14 subsidence but it's certainly not our intent that that
15 would happen and the techniques that we will use will
16 be the best that we have available to prevent that from
17 happening.

18 Q All right. Could you
19 comment on whether you feel that your needs for gravel
20 might reflect the fact that you are planning to be
21 located in an outer delta area as opposed to an upland
22 area such as the gulf area? I don't mean a real up-
23 land but a higher, drier area.

24 A In terms of quantity?

25 Q Yes. For maintenance.

26 A For maintenance.

27 Q Yes. You've spoken of
28 flooding for example. As a problem that might require
29 the need of gravel to maintain dykes that had slumped,
30 etc.

Faulkner & Serra
Cross-Exam by Bayly

1 A Oh. I get your question.
2 I thought that you were asking about our intial gravel
3 requirement.

4 Q No. I'm talking about
5 this amount -- this 50,000 cubic yards per year for
6 maintenance.

7 A Yes. I think that that's
8 very fair to say that our figure there of 50,000 yards
9 a year has definitely taken into account the fact that
10 we have a few more problems that might come along than
11 we would if we were in a more desirable construction
12 area.

13 Q Now can I refer you to
14 your thick yellow^{book} at page 2-56? In the paragraph
15 entitled "transportation and logistics". You're not
16 going to have a permanent airstrip on the site?

17 A That's correct, yes. A
18 permanent fixed wing airstrip, no.

19 Q That's what I was referring
20 to. And you contemplate using helicopters from camp
21 Farewell to Niglintgak to bring personnnel in and out
22 of the facility?

23 A Yes sir.

24 Q Now. You've said in this
25 paragraph "fixed wing aircraft and helicopter flights
26 within the Kendall Island Bird Sanctuary will be operated
27 in strict accordance with the procedures to be agreed
28 upon with land use and Canadian Wildlife Service offic-
29 ials. Do you contemplate having to use some other
30 mode of transportation when birds are nesting?

Faulkner & Serra
Cross-Exam by Bayly

1 A We do not comtemplate
2 that, no. Just to elaborate a bit on that. During
3 current drilling operations in the area, when we do
4 operate there during the critical bird nesting seasons
5 we have certain restrictions applied to the use of
6 helicopters, but they certainly have not been -- you
7 know-- seen fit to prevent us from using helicopters in
8 the area of the sanctuary in which we are located.

9 Q And your -- will you agree
10 with me that the fact that you have been given per-
11 mission may not necessarily reflect whether you have
12 some impacts on nesting birds? There may be some
13 trade-offs involved in the granting of permission.

14 A Oh, I'm certain there is,
15 yes sir.

16 Q And will your environment-
17 al panel, Mr. Ballem, be dealing with this question
18 as it relates to this facility?

19 MR. BALLEM: I would imagine
20 that they would be able to respond to your questions
21 in this area. We can only try and find out.

22 A I think
23 I could comment on that. Yes, they will be prepared
24 to address the impacts on the bird population in the
25 area.

26 Q I'll leave this area of
27 questioning until that panel is on the witness stand.
28 On page 4 of your evidence you refer to -- at the bottom
29 line -- "liquid hydrocarbons ^{recovered} during processing will be
normally burned as plant fuel". Do you anticipate

Faulkner & Serra
Cross-Exam by Bayly

that there would be any liquid hydrocarbons for sale?
From that plant?

A I'm not sure that I know
how to answer that one. I'll give you my understanding
of it at the moment and that answer is "no". As we
have stated in the evidence, I think in several places,
this is a very dry gas stream. There are very few
recoverable liquid hydrocarbons in any event and we
think that -- well normally there will be no surplus
hydrocarbon if we burn it as plant fuel. And we need --
well, we need plant fuel of some sort and of course that
could be raw -- well, natural gas itself or the liquids
separated from it or some other source that we have to
bring in. But provided that we go ahead with the
scheme as we have outlined it here to burn the hydro-
carbons as fuel -- liquid hydrocarbons as fuel -- there
will be no surplus to either be disposed of or to be
sold, so my impression at this point in time is that
no, there will not be any.

Q So the needs of the plant
would be greater than the quantities you would antici-
pate could be produced.

A That is correct, yes.

Q Now on page 8 of your
evidence, at the fourth paragraph, you talk about the
rig substructure being supported on timber piles and
that pile supports may also be installed under other
heavily loaded portions of the rig. Now I take it
these are timber piles in both instances, are they?

A Yes, I think that's fair

Faulkner & Serra
Cross-Exam by Bayly

1 to assume. That's what we use on current exploration
2 operations and that's what my intent was when I wrote
3 this.

4 Q Could it be that steel
5 pilings could be substituted for timber pilings?

6 A Most assuredly, yes.

7 Q And with regard to your
8 above ground feeder lines, is it possible that those
9 could be mounted on steel as well as timber pilings?

10 A Yes sir.

11 Q And with regard to the
12 location from which you would intend to get timber
13 pilings, do you have a number of options.

14 A I think our official pos-
15 ition on that is that we -- we will not be going out
16 and cutting piles ourselves as Shell or as a contractor
17 of Shell, and that we would hope that there will be
18 local contractors who can supply our piling needs. And
19 that they will be the people who search out and locate
20 the suitable sources of timber.

21 Q So, in a sense -- and with-
22 out trying to be unfair, you'd be passing on any
23 environmental concerns with regard to the locations from
24 which pilings were taken, to the contractor and the
25 government regulatory agencies?

26 A I think that's fair to say,
27 yes.

28 Q On the subject of flow lines,
29 have you examined the possibility of flow lines being
30 damaged or even ruptured because of flooding or storm

Faulkner & Serra
Cross-Exam by Bayly

1 surges?

2 A The possibility from what
3 angle, Mr. Bayly? We concede that yes, it could happen.

4 Q And what steps have you
5 taken to ensure that it won't happen? Or to at least
6 to try and prevent ^{it} from happening?

7 A Well, I guess primarily,
8 the protection against flooding will be the fact that
9 the pipe itself will be elevated above the ground to
10 a point that we think it will ^{be} clear of any inundation
11 by water that occur s and, in addition the pile supports
12 that hold it up in the air will be designed with --
13 to withstand the impact that we would expect that they
14 might have to withstand.

15 Q Now, I notice that your
16 flow lines-- at least in your diagram in Figure 1 --
17 are located quite close to the river channel. Is that
18 the safest place as well as perhaps the shortest dis-
19 tance between two points?

20 A I think it's fair enough
21 to say that our gathering system, when it's engineered,
22 will attempt to take the shortest distance between the
23 two points. As far as the safest place, I think that
24 that is probably no worse or no better than any other
25 place that we could build them along there, sir. There
26 is very little change in elevation throughout any of
27 that area at the south end of that island where
28 our projects will take will place.

29 Q Have you examined with
30 relation to your designated placing of the flow lines

Faulkner & Serra
Cross-Exam by Bayly

1 the bank degradation in the channel?

2 A Not to any si
3 degree at this point in time, but that will be under-
4 taken. You're thinking in terms of erosion of the
5 bank and eventually reaching our proposed pipeline
6 corridor?

7 Q That's right. If the
8 bank caves in and the pipeline -- flowline is on the
9 bank, then I'm assuming that the -- it will either
10 rupture or you'll get these dips in it that will allow
11 hydrate slugs to form -- which I understand is one of
12 the dangers you want to avoid.

13 A Absolutely. Sir, we have
14 no definitive work on that at this point in time, but
15 when that pipeline right of way is finally located,
16 that point will have been looked at as best we can.

17 Q So, it's impossible to
18 say at this point how far is a safe distance back from
19 the bank in terms of the life of the project?

20 A Yes sir. I think that's
21 fair to say, at least from my point of view.

22 Q If you did have a broken
23 flowline as a result of some accident, either one that
24 was caused naturally by a storm or perhaps by somebody
25 backing a piece of equipment into one, what are the
26 consequences that could be expected.

27 A We have some figures in
28 the yellow book -- the big yellow book -- and I won't
29 try to find them now, but certainly the consequences
30 are a release of a certain amount of gas and that will

Faulkner & Serra
Cross-Exam by Bayly

1 depend on just where the break occurs and how long
2 a section of line is open. There is also the possibility
3 of liquids being spilled and we have put some numbers
4 on that possible escapement in the yellow book, again.
5 And I -- that's the main consequences of it.

6 Q Is there a possibility of
7 fire?

8 A I guess that there certainly
9 ly is some possibility of a fire taking place. Yes sir.

10 Q Is there a possibility of
11 an explosion?

12 A I'm afraid I can't really
13 answer that, I guess I'd have to think that there is
14 a possibility, but I'm not sure that I'm the man who
15 can address that.

16 Q We've -- perhaps the
17 policy panel will be able to address this or --

18 THE COMMISSIONER: Do you have
19 a policy on explosions?

20 MR. BALLEM: I don't know sir,
21 that there is an expert on that subject matter.

22 MR. BAYLY: Well it might be
23 something that Mr. Ballem could find out from his
24 client.

25 MR. BALLEM: I think that's
26 the best solution. We'll make an enquiry and put it
27 on the record.

28 Q Now, I understand that the
29 that the pressure will be in the order of 1400 pounds
30 per square inch, is that correct?

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Cross-Exam by Rayly

1 A No. I don't think that is
2 correct. That will be the design pressure of the
3 system as we see it now, but we are anticipating that
4 from Day 1 in the field, we will be producing those
5 wells at a wellhead pressure about 800 PSIG or slightly
6 in excess of that so it will be more in the 800 to 850
7 range, I would suggest.

8 Q Now, with regard to running
9 into delivery lines and running into trunk pipelines that
10 carry gas, we hear from time to time that explosions
11 can be caused and that there can be danger to life and
12 the pressures, as I understand, are not as great at 800
13 pounds per square inch as they would be in a trunk line?
14 How do they compare with lines that run from the trunk
15 line into say a community or a factory that is being
16 delivered gas?

17 A I'm afraid I don't have
18 the total answer to that but I would guess that 800PSI
19 is not an uncommon delivery pressure to have in some
20 you know - city services for instance. But I stand
21 to be corrected on that if there's someone with better
22 information.

23 Q Perhaps if there is some
24 other information that Shell has, that Mr. Ballem
25 could announce that at the appropriate time.

26 MR. BALLEM: Well, yes. Subject
27 to this reservation, that Shell is certainly not in the--
28 to my knowledge in the utility distribution business --
29 and I really don't think this was in our area of expertise
30 but if we do find something different, we'll try and

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Cross-Exam by Bayly

1 help.

2 Q Well looking at the
3 counsel table here, there may be somebody who represents
4 somebody who wants to deliver gas, Mr. Commissioner, they
5 may be able to help us out on that. Now, on this
6 question of line breaks is there a possibility, looking
7 at page ten of your evidence that hydrate formation
8 could cause line breaks, or will it only cause these
9 surges that you have described?

10 A I'm not aware of hydrate
11 formation being a cause of line breaks, no sir. I
12 suppose you're getting at the point of hydrate plug
13 blocking a line and subsequently pressure building up
14 behind that plug to the point where it would burst the
15 line.

16 Q That was the idea that I
17 had, yes.

18 A That shouldn't happen. We
19 will have shut-down devices on the various wells that
20 are triggered on -- triggered by the detection of a
21 rising pressure in the flow line system. In addition
22 to that I think in the Niglintgak area in particular,
23 those flow lines will be adequate -- or be close to
24 adequate to hold -- withstanding the full wellhead
25 pressure, even if the safety device failed.

26 Q On page ten again, you
27 have a paragraph on methanol and corrosion inhibitor.
28 And most of the evidence we've heard with regard to
29 methanol from the would-be pipeline builders are that
30 they would plan to discharge methanol into water courses

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Cross-Exam by Bayly

1 either onto ice or at a fixed rate so that it would
2 produce a solution of less than 1 per cent. And, you
3 haven't elected that, you appear to be intending to
4 inject methanol back into the ground and have you
5 thought that there are environmental problems that
6 have caused you to elect this procedure?

7 A Sir, I'm not sure we're
8 speaking of the same matter here at all. You're talking
9 of the pipeline companies disposing of methanol after
10 use through --

11 Q They're using it for
12 hydrostatic testing of the pipe and then talking about
13 discharging it into water courses.

14 A Let me clarify then. The
15 methanol that we're talking about here is methanol
16 that's going to be stored at the plant -- or stored
17 at the well pads prior to use. Methanol is a chemical
18 that can be injected into the gas stream, if, for
19 instance, pressures and temperatures reach the point
20 where you're getting near the situation when a gas
21 hydrate would form. Injection of methanol into the
22 system will depress that hydrate formation temperature
23 and therefore allow you to continue to produce that line
24 where otherwise it might freeze up. So the methanol
25 that we're talking about here is methanol that will
26 either be injected into the gathering line or into
27 the well tubulars themselves, if for some reason you
28 were getting a cold flowing condition in the well
29 itself. And the methanol that will be injected into either
30 the well or the flowline will be carried through the

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Cross-Exam by Bayly

1 gathering system to the plant and will be disposed of --
2 or will go into the sales gas.

3 Q The methanol will be sent
4 south?

5 A That is correct, yes.

6 Q Perhaps you and Arctic
7 Gas in Foothills can get together, and that might be a
8 convenient way of disposing of their methanol?

9 A Well, I think we're talking
10 of different quantities.

11 Q Could we turn to page
12 15 of your evidence? Tell me, how tall, approximately,
13 the willows are in this willow-herb zone through which
14 most of the flow lines pass?

15 A They are very short, sir.
16 Knee-high, I would suggest.

17 Q Well, you've talked about --
18 you've talked about preparing ^{the} right-of-way, clearing
19 brush for an elevated line?

20 A Yes sir.

21 Q Is it necessary to clear
22 this brush?

23 A NO. That's a very good
24 point ^{you have} there. This statement is rather a general one
25 and I think a lot of the inference there doesn't
26 specifically apply to the Nig area or the type of
27 clearing that we would have to do. We -- I guess we
28 do not anticipate that there would be any great extent
29 of brush that would have to be cleared at all.

30 Q And, I take it you've

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Cross-Exam by Bayly

1 considered that if you did clear this brush, you might be
2 doing more harm than good in terms of inducing the
3 thermal degradation?

4 A Yes, sir. We're certainly
5 aware of that and I think it's fair to say that during
6 the pipelining operation there will undoubtedly be
7 some of this brush that's damaged, but we would expect
8 that leaving it there and working around it is a better
9 solution than removing it and trying to revegetate
10 with something else.

11 Q Now, could I ask you to
12 look at Figure 3? It appears from the lines in Figure
13 3 as though certain activities will continue twelve
14 months of the year. Are these lines meant to show
15 that?

16 A In general, I think that
17 was the intent. Do you have a specific instance, Mr.
18 Bayly?

19 Q If we look at the construc-
20 tion activities, starting in what I would guess is
21 around September of 1978, somewhere after the -- some-
22 where around three quarters of the way through 1978,--

23 A Yes sir.

24 Q It appears that these
25 construction activities and these installation of
26 field erected facilities will not be a winter or summer
27 construction project, but will continue until the job
28 is finished?

29 A Yes, I think that what we're
30 talking about there are field facilities that will be

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Cross-Exam by Bayly

erected on prepared surfaces of some sort, and wouldn't necessarily continue during that entire time span but in our estimation, could be carried out during that span, if required.

Q Well, have you had any discussions or indications from the Department of Indian Affairs that you'll^{be} able to get land use permits to keep on this schedule?

A Well, to turn it around, we've had no indication thus far that permits for that sort of activity wouldn't be allowed.

Q You usually have to test that by making an application though, don't you?

A I would expect so, but I think there are certain precedents; for instance, in building rig foundations for exploration rigs, we have been active in that area during -- I guess you're referring to the critical summer months, for instance?

Q Yes.

A And have had construct-- small issue construction equipment admittedly, but construction activities ongoing during that period.

Q Well, do you direct copies of your thick yellow book and your evidence to the Land Use Advisory Committee, or do you just expect them to read them and send you a letter saying that you will or won't likely be granted the land use permit that you haven't applied for yet?

A We have not directed copies of that directly to the land use authorities. We under-

Faulkner & Serra
Cross-Exam by Bayly

1 stand that these applications will be reviewed with
2 the appropriate authorities, and yes, certainly when
3 the time comes to carry out certain operations, we
4 will have to file further permit requests.

5 Q Well, I would anticipate
6 and you can correct me if I'm wrong, that you will
7 have to go and test this out to see whether your cons-
8 truction schedule is likely to be one that you will be
9 allowed to follow. Would that be fair to say?

10 A Oh, I think that's very
11 fair to say, yes.

12 Q And you have no indication
13 one way or the other from the government that this will
14 be permitted, except for silence?

15 A In my experience, yes,
16 that's correct. We have had very little reaction to
17 information filed by the companies as to whether the
18 sorts of things that ^{we} postulate will be allowed.

19 Q Now, I note that you
20 restricted that to "in your experience" and perhaps Mr.
21 Ballem could indicate upon investigation as to whether
22 this is in fact the experience of the company, or whether
23 that somebody else's department.

24 A I think -- I'm
25 speaking for Shell when I say that. I am not sure what
26 talk there may -- what the per -- communications there
27 may have been between governments and the other companies
28 that are represented here for instance.

29 Q All right. So when you
30 say, "in my experience", you mean in Shell's experience?

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Cross-Exam by Bayly

1 A Yes sir.

2 Q If your gas facility --
3 your processing facility actually only last twenty
4 years, what are you going to do with it at the end of
5 the twenty years?

6 A Well, we have some comments
7 on that again in the land tenure application here, but,
8 it will be our intention to dismantle and make safe
9 the facility and remove basically the process parts of
10 the system, and if you'd allow me, I might just find
11 that particular passage where we make some comments
12 and address myself to that.

13 Q I think its at 272 perhaps.

14 A Yes, I believe that's
15 right. Page 2-72 in the land tenure volume.

16 Q There's no mention in that
17 of whether you have ^are-vegetation program or even if
18 one is possible. It talks about restoring the right-
19 of-way, but I'm not sure that that covers that point.

20 A Well, I guess we had intend-
21 ed that where we say things like "right-of-way will be
22 restored" the intention is that if there is a re-vege-
23 tation required, it will be carried out then as well,
24 but we have there five general statements regarding
25 how we would abandon the certain facilities -- the
26 wells, the elevated pipelines, the plant and so on and
27 so forth and that summarizes generally the type ^{of} abandon-
28 ment procedures that we would use.

29 Q Would you be burying any
30 of the stuff. Any things that couldn't be salvaged or

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Cross-Exam by Bayly
Cross-Exam by Scott

1 that in the opinion of the company weren't worth taking
2 back south?

3 A I guess the only things
4 that I can conceive of being buried would be the normal
5 sort of things that a person might dispose of in a
6 land fill area. But I would think that the bigger
7 components would certainly all go south. Certainly
8 maybe some scrap metals or some scrap materials of
9 some sort might be left here, but that would all be
10 governed pretty closely ^{by} regulatory bodies too, I'm sure.

11 Q Right. I realize things
12 have come a long ways since the CANOL pipeline was
13 built, but even nowadays there are dead vehicles and
14 this sort of thing that aren't worth salvaging and
15 oil drums, etc that seem to just find their way into
16 heaps rather than into either land fill sites or onto
17 barges going south. Would you anticipate this being
18 something that would be at least a visual impact on
19 the north?

20 A I can't conceive of us
21 trying to get away with anything like that, Mr. Bayly,
22 and I'm sure we wouldn't be allowed to if we did try
23 it.

24 MR. BAYLY:

Right. Those are all the

25 I have. Thank you gentlemen.

26 CROSS-EXAMINATION BY MR. SCOTT:

27 Q Would you
28 turn first to Figure three in your evidence, Mr.
29 Faulkner? First of all, I understand that Shell, along
30 with the other companies, has made ^{to} the government an
31 application for a land tenure agreement?

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Faulkner & Bavly
Cross-Exam by Scott

1 A That is correct. The
2 three companies individually have made these applications
3 yes.

4 Q And your big yellow volume
5 is indeed material filed with the government in support
6 of that application?

7 A Yes, in fact it is basically
8 the application.

9 Q Yes, all right. And in
10 due course if all goes well, I take it that it's your
11 assumption that some land tenure agreement will be --
12 will be granted?

13 A Yes sir.

14 Q And I take it that you
15 wouldn't move very far along your construction program
16 until that had happened?

17 A I think that's a fair
18 assumption, yes sir.

19 Q And looking at the work
20 that you've set out on figure three, I take it that
21 substantially none of that work would be done until
22 an agreement or an undertaking to obtain -- to be
23 granted an agreement was in your hands?

24 A Speaking from Shell's point
25 of view, yes I think that is absolutely correct. We
26 will proceed with the Phase 1 engineering that's identi-
27 fied here prior to that time, but, beyond that it --
28 we would not commit to any expenditures or many expendi-
29 tures without having a fairly firm assurance that we
30 would be allowed to go ahead with our project.

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Cross-Exam by Scott

Q Well, let's see if I understand. Do you tell me that you would do the Phase 1 engineering without any undertaking or assurance about a land tenure agreement?

A Yes sir. We're preparing now to go out and find that outfit that will do Phase 1 engineering for us, and we expect that we will have him selected and we will be working with him before we get approvals.

Q But as to Phase 2 engineering and the other stages that are shown on your chart, you wouldn't proceed without either an agreement or a fairly firm assurance that you were going to get one?

A Yes, sir. Now if this is important to you, you may wish to address that to our policy witness again when he appears.

Q All right.

A It's my understanding that we would not proceed very far without that agreement in hand.

Q And as far as you know, at least, and we can deal with the policy witness later -- there is no assurance at the present time that you will get such an agreement?

A That is correct.

Q And I take it also that you wouldn't go very far until you determined whether one of the applicants for the construction of a trunkline was going to get its land and its NEB approval?

A Sir, as I understand the

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the procedure, none of the proposed gas development projects will get land tenure approvals until a gas pipeline approval is granted.

Q Well, what I'm trying to simply get out is, what I understand to be the situation, namely this -- that you're not going to do any work beyond Phase one until Shell has a land tenure agreement or a pretty good promise of one and until a pipeline applicant has got all the appropriate approvals?

A Yes, sir.

Q OK. Well now, looking at this chart, when do you anticipate that the tenure agreement will be granted or assurance given that one will be granted? -- Looking at this chart.

A I think the basic assumption that has gone into this, sir, is that we would have that approval late in '76 or very early in '77, at the very latest.

Q And would those be the same dates for pipeline approval? Are those the assumed dates as well for pipeline approval?

A No, I don't think that you should make that assumption.

Q Well, what, I'm sorry.

A I would just be stating personal opinion if I ventured anything on that, and for basis of presenting some sort of a construction schedule, we have made a -- I think an independent and arbitrary assumption about when we might get our approvals and I don't think you should attempt to tie

this figure to any pipeline approval schedule that you might have.

Q No. But in order to make your assessment about when you are going to start, you've already told me that you have to make a guess or a judgment as to your land tenure agreement^{date} and you have to make a judgment as to when Arctic Gas -- I shouldn't say Arctic Gas -- as to when one of the applicants is going to be approved by the appropriate authorities?

A Yes sir.

Q All right. Now I take it that you've made those assumptions and they come down to this -- that those two approvals will be available some time early in 1977 at the latest.

A Yes, I think that's fair enough.

Q All right.

A And if they aren't available then, this schedule becomes obsolete.

Q All right. Well now, what is your judgment as to when those two things will be done?

A Sir, I'm not sure that my judgment on that is of any real importance here.

Q Well, we can only tell that after we hear what it is. What I'm getting at, is I would like to have from Shell as realistic a construction schedule as possible and that depends to a certain extent in knowing when you anticipate you will be able

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Cross-Exam by Scott

1 to begin. For example, you can recognize that the --
2 your commencement date is going to determine ultimately
3 your costs -- assuming inflation carries on.

4 A Yes sir.

5 Q So what I'd like to know
6 is what is the company's best judgment as to when it
7 may reasonably anticipate a land tenure agreement or
8 a decision being made about that.

9 MR. BALLEM: If I may just
10 interject there, Mr. Commissioner, I think that implicit
11 in that is the company's judgment of when a pipeline
12 permit may be issued, and I think the witness is saying
13 that he doesn't feel qualified to speculate as to that.
14 Possibly the policy witness would feel that he could.
15 But I don't really think it's a proper question to be
16 directed at this witness.

17 THE COMMISSIONER: I think there's
18 a lot in that Mr. Scott. What does Mr. Faulkner's
19 opinion

20 MR. SCOTT: I don't insist
21 on Mr. Faulkner's opinion. Indeed I don't want his,
22 I want Shell's opinion and I don't care which officer
23 of Shell it comes from -- if the policy witness is
24 going to be able to use the corporate judgment on this
25 matter -- I'll be grateful and I'll wait until then.

26 MR. BALLEM: Well it
27 may be that there is no corporate judgment on that,
28 but let's wait till then. I think it might be more
29 appropriate.

30 MR. SCOTT: Well now, Mr.

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Cross-Exam by Scott

1 Faulkner, you told Mr. Bayly that you were unable to--
2 or that you did not have any estimate of the tonnages
3 that would be involved in construction of the project
4 that is here described. Did I have that correctly.

5 A Yes, that's correct sir.
6 I personally do not have them here. Now, we have
7 volunteered to provide those and, during the coffee
8 break I had a chance to chat with one our other members
9 and we can in fact provide estimates, in inverted commas,
10 in fairly short order.

11 Q Right.

12 A They are ball parkish type
13 estimates.

14 Q I would presume that those
15 estimates will be -- ^{it} may be obvious to say it, but
16 all inclusive, that is, all items to be brought
17 into place will be considered?

18 A Yes, sir, as far as we
19 can see them now.

20 Q Is it possible in the
21 same way to obtain for us any "estimate" of your barge
22 requirements?

23 A Well, the figures that we
24 have undertaken to provide are basically going to be
25 tonnages which I think either you or we can then
26 interpret, as far as barge requirements.

27 Q I'd like you to do that,
28 if I did it, no one would pay any attention to my
29 conclusion but if you do it, -- it will be the judgment
30 of Shell and I'd appreciate it if you could do

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Cross-Exam by Scott

1 that for me.

2 A I feel confident that we
3 can provide you something there, sir.

4 Q Do I understand that the
5 only barge traffic that you're going to have that's
6 going to come around the top will be barges carrying
7 the modules for your project?

8 A The modules and whatever
9 other equipment might conveniently be carried on those
10 barges that carry the modules. We do not at this
11 time anticipate that we would go to a total sea-lift
12 for instance.

13 Q But I take it that the --
14 that that route is for the modules and while you'll fill
15 up the barges -- all other transport will come via the
16 river?

17 A That's our best estimate
18 at this time, yes sir.

19 Q What other sort of material
20 or equipment might you carry with the modules on the
21 barges?

22 A Well, I think that would
23 depend very much on just what might be available at
24 that time, but things that I can conceive of, for
25 instance are, oh, flare stacks, maybe some tanks that
26 were prefabricated and brought around, or materials
27 with which to build tanks or material of that sort.

28 Q How about fuel? Or is
29 most of that going to come down the river?

A I think it's fair to say

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Cross-Exam by Scott

1 that we estimate now that our fuel would come down
the river and I think the only reason we would choose
3 to bring it around via ocean would be if there were some
4 problem in getting it through the river route.

5 Q Well, now, you were here
6 I gather when Imperial Oil gave evidence and was
7 examined yesterday?

8 A Yes sir.

9 Q And you heard me ask
10 their witnesses about the numbers of persons that
11 would be required in respect to their project.

12 A Yes sir.

13 Q And you heard me divide
14 up with them their project into three portions -- first
15 of all the construction phase, the second the breaking-
16 in phase and thirdly the operation -- the routine
17 operations and maintenance phase.

18 A Yes sir.

19 Q And do you -- can you make
20 those kinds of divisions in respect of the Shell
21 project?

22 A I think the same divisions
23 apply. I'm not certain that this break-in phase, as
24 you call it, is necessarily a ^{very} significant phase or is
25 not necessarily very different from the operations
26 phase, per se, but yes I can make those same distinctions
27 sir.

28 Q Can you let us have your
29 manpower requirements in totality for each of those
periods?

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Cross-Exam by Scott

1 A Yes sir. I can't per-
2 sonally, but I understand that one of the subsequent
3 panels is preparing that sort of information.

4 Q Could you turn to page 5
5 of your evidence?

6 THE COMMISSIONER: What time
7 is it Mr. Scott?

8 MR. SCOTT: Twenty five to one.

9 THE COMMISSIONER: Don't you
10 think we should adjourn for lunch?

11 MR. SCOTT: I'm agreeable.

12 THE COMMISSIONER: All right,
13 two o'clock.

14 (PROCEEDINGS ADJOURNED TO 2 P.M.)
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Cross-Exam by Scott

1 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

2 MR. BALLEM: Mr. Commissioner,
3 Mr. Bayly asked Mr. Mainland if he could sort of list
4 the 100 tons of miscellaneous on page 2-24 of the
5 information in support of the land tenure application
6 under the heading, "Drilling materials", and I'm now
7 in a position to put that on the record, if I might.

8 THE COMMISSIONER: Fine.

9 MR. BALLEM: It's lubrication
10 and hydraulic oil, 20 tons; glycol for the conductor
11 pipe refrigeration system, 10 tons; and then the
12 remaining balance of 70 tons is comprised of conductor
13 pipe, float collars, shoes, centralizers, and something
14 else -- and stop rings, cementing plugs, casing hangers,
15 bits and stabilizers, and lumber. That comprises the
16 100 tons of miscellaneous drilling material.

17 MR. SCOTT: Have you finished,
18 Mr. Ballem?

19 MR. BALLEM: Yes, I have, Mr.
20 Scott.

21 MR. SCOTT: Mr. Commissioner,
22 I had some filings to make this afternoon but I don't
23 have them here. I've asked Miss Carriere to get them and
24 when she brings them over I will make them.

25 Q Has Shell given any
26 consideration to whether it might utilize in transporting
27 supplies and equipment, the Dempster Highway or the
28 Mackenzie Highway, if they be finished in time?

29 WITNESS FAULKNER: We have
30 not considered them at this point in time, and I guess

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Cross-Exam by Scott

1 -- well, the answer to that is "No," we have not
2 considered them.

3 Q Well, with respect to the
4 Dempster, why not?

5 A I'm afraid I can't
6 really answer that question. I am not prepared for it
7 and I don't have a good ready answer for you.

8 Q At page 5 in your
9 prepared evidence in the second paragraph on that
10 page you deal with the crossing of the Kumak Channel
11 and I wonder if you could tell us what the problem is
12 at that channel that you perceive?

13 A Yes sir. Well, I guess
14 the main problems are the shape of the channel itself.
15 In the land tenure document there is an appendix which
16 shows some channel cross-sections taken at various
17 places there. I think the gist of the problem is that
18 there is a large flow through that channel and due to
19 the flow characteristics of the stream in that area,
20 the deep part of the channel lies hard up against one
21 shore there, and in going from the dry land into the
22 channel you drop very rapidly to deep water, something
23 in the order of 60 foot of water, I believe, in just
24 a very short distance. Being also in that region
25 there is discontinuities in the permafrost table
26 through there, and I think that -- well, in summary
27 that's the basic problem; - trying to get a satisfactory
28 entry into the ground and making sure that your installa-
29 tion will remain intact. It looks as if it should be
30 a stretch of the river where erosion, you know, could

Faulkner & Serra
Cross-Exam by Scott

1 be a very serious consideration.

2 Q Well this, I take it,
3 is a local problem that is apparent in that stretch of
4 the river.

5 A That's in that stretch
6 of the river particularly, yes sir.

7 Q So that the problem is
8 one of the physical characteristics of the terrain and
9 the construction techniques and know-how required to
10 cross it.

11 A That's correct, yes sir.

12 Q The problem, I take it,
13 has nothing to do with the behaviour of raw gas in the
14 pipe as opposed to the behaviour of compressed processed
15 gas.

16 A That has some bearing on
17 the design, certainly, sir, but the major problem that
18 we see is trying to cross at that physical section of
19 the river.

20 Q What bearing does the
21 fact that you're carrying raw gas have on the existence
22 or solution of the problem? You said it had some;
23 and I frankly didn't understand how it could have some.

24 A Oh, well, I think what I
25 meant there is in looking at any river crossing, a
26 buried river crossing, the fact that we are transport-
27 ing raw gas and the fact that there can be liquids
28 dropping out and accumulating in the low spots in the
29 line, or the extra hazards perhaps of hydrating off
30 the line under the river bed, these sorts of considera-

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Cross-Exam by Scott

1 tions have to be taken into account at any river
2 crossing.

3 Q Yes, but what is at
4 stake there is the extent of the risk, if there should
5 be a difficulty or trouble; that fact does not make
6 the crossing more difficult.

7 A Yes, I guess that's fair
8 to say, sir.

9 Q It's not more difficult
10 to cross because you are carrying raw unprocessed gas,
11 than if you were carrying compressed gas?

12 A No, the physical construc-
13 tion is no more difficult one way as opposed to the
14 other.

15 Q Well now, you say that
16 to respond to this problem you may go to a suspended
17 structure. Now what sort of structure did you have in
18 mind when you wrote that?

19 A That's a preliminary
20 statement, sir, but there are -- there certainly are
21 suspended type stream crossings; the sort of thing
22 one might consider is, well almost a suspension bridge
23 type of an affair with fixed supports on either bank of
24 the shore and the pipe suspended -- well, supported by
25 those supports through a series of guy-wires or some
26 such arrangement.

27 Q Have you done any work
28 as yet on plans for that kind of thing?

29 A Very little, sir, very
30 little.

Faulkner & Serra
Cross-Exam by Scott

1 Q Well now, all this leads
2 me to the second-last sentence in that paragraph:

3 "Bell intends to carry out additional work
4 regarding the feasibility of drilling and
5 tying in this particular well and understands
6 that a rigorous examination of the proposed
7 river crossing design would be carried out by
8 DIAND before^a construction permit would be
9 issued. "

10 Now, leave aside the first part of that sentence,
11 which relates to the additional work that you're going to
12 do, and I ask you to zero in on your understanding that
13 a rigorous examination of the design will be made by
14 DIAND. Where did you get that understanding from?

15 A Well, I guess we've
16 taken something a little bit out of context here, sir.
17 Before we get permission to go ahead and build anything,
18 be it this river crossing or our proposed dock or our
19 road system or anything like that, we will have to
20 file for a construction permit that will be granted by

21 Indian Affairs & Northern Development and I guess
22 the point I was trying to make here is that -- was to
23 reiterate that we know that our design or any design
24 that we come up with for that crossing will be
25 closely examined before we get our approvals.

26 Q At what stage of the
27 process is that done? Will this be done after final
28 design of that crossing has been prepared?

29 A Yes sir, that's correct.

30 Q I'm sorry, go ahead.

Faulkner & Serra
Cross-Exam by Scott

1 A I was just going to say
2 that in our discussions with DIAND, the construction
3 permit is something that will follow, well, approval
4 of our land tenure application and before we go ahead
5 and start to do anything physically on the ground.

6 Q So would it be correct
7 to say that as a result of your discussions with DIAND
8 you have concluded that before permits are issued,
9 for individual crossings, you will be obliged to file
10 in effect, final design for those crossings which have
11 to be approved.

12 A Yes sir, that's correct.

13 Q Yes, and so the approval
14 to which you refer in that sentence is not related
15 to this particular crossing, but is the kind of
16 approval that you understand will be necessary if you
17 have other crossings to make as well.

18 A And not only crossings
19 but virtually any construction that is required on
20 this project at all, sir.

21 Q Now, are you aware
22 whether this plan -- perhaps you're not and if you're
23 not you can certainly tell us -- whether this
24 crossing at Kumak is any worse than literally hundreds
25 of crossings of rivers up the Mackenzie Valley which
26 the applicants will have to make, or do you know
27 anything about that?

28 A I am afraid I know
29 very little of the applicants' particular problems.
30 I frankly can't answer that question.

Faulkner & Serra
Cross-Exam by Scott

1 Q May I ask you to turn to
2 page 2-14 in the large volume and I'd like simply to
3 read paragraph (a) at the top of the page and then ask
4 you to comment on it because frankly I don't understand
5 what your company is saying here.

6 "The construction and operation of the wet
7 gas gathering line that would be required
8 between Taglu and Niglintgak, if facilities
9 were to be shared, posed many potential
10 technical and environmental problems that are
11 outside the applicant's area of expertise.
12 The construction of the several major river
13 crossings that would be required along the
14 route was one particular item of major con-
15 cern to the applicant. Shell believes that
16 a transmission line operator should be able
17 to construct and operate such a line, parti-
18 cularly a dry refrigerated buried line such as
19 proposed by the two companies who have filed
20 for permission to construct the Mackenzie
21 Valley Gas Pipeline, with less environmental
22 impact than Shell could construct and operate
23 a heated above-ground gathering system."

24 Now first of all, that line is shown on one of your
25 figures in your evidence, and what is that for?

26 A The line the way it is
27 shown on our figure?

28 Q Yes.

29 A That would be a line that
30 would transport the processed gas from the Niglintgak

Faulkner & Serra
Cross-Exam by Scott

1 plant into the major transmission system.

2 Q And at Taglu?

3 A Well, we anticipate that
4 that's where it would be tied in, but we have no
5 control over that particular one. I think that Arctic
6 Gas' latest filing shows that as one of their laterals
7 though, yes.

8 Q And the original scheme
9 was that you would -- that you, Shell, would construct
10 and operate that.

11 A Yes sir, that's correct.
12 Going back to that October '74 submission, which I
13 think the Commission has in their possession -

14 Q And the present scheme
15 is that in fact it should be constructed and operated
16 by one of the applicants.

17 A Yes sir, that is correct.

18 Q And your understanding is
19 that it therefore becomes part of the applicant's line?

20 A Yes sir, that's correct.

21 Q What is the problem that
22 you refer to, if I may say so, a little indirectly in
23 that paragraph? 2-14, sir.

24 A It's hard to say one
25 specific problem, but there are several problems
26 associated with, first, building and then secondly
27 operating an above-ground wet gas transmission
28 system. I think we could enumerate quite a few of
29 those, but some of the most serious from an operations
30 point of view are the possibility of developing hydrate

Faulkner & Serra
Cross-Exam by Scott

1 stoppages in that line and subsequently removing that
2 blockage, particularly in the cold winter months. It's
3 difficult to accomplish much of anything in that period
4 and if for some reason, flow was interrupted, for
5 instance, it's a very real problem to keep that line
6 unplugged if you did have a field upset for some
7 reason that meant that you were no longer transporting
8 gas through that line, you know, continuously.

9 Q Well, Mr. Faulkner,
10 you're talking about operation now. Let me just see
11 if I can put my finger on what might be an easier
12 explanation and perhaps you can tell me. I take it
13 that this line was originally drawn at a time when you
14 did not intend to have a processing plant at Niglintgak.

15 A That's correct, sir,
16 yes.

17 Q And therefore it was
18 simply another gathering line that would take gas to
19 Taglu.

20 A That's correct, yes.

21 Q And gathering lines are
22 your business.

23 A Yes sir.

24 Q Or among your business.

25 A M-hm.

26 Q Then when you decided to
27 build a processing plant, this became unnecessary, if
28 you will, as a gathering line.

29 A I think we're getting at
30 things a little backward here.

Faulkner & Serra
Cross-Exam by Scott

1 Q Maybe.

2 A What was your question
3 to me?

4 Q What I am asking is you
5 suggested in this paragraph, you suggest in this
6 paragraph that there is some engineering difficulty --

7 A Yes sir.

8 Q -- involved in construct-
9 ing that line. Now as we haven't heard from either of
10 the applicants about ^{any} engineering difficulty involved
11 there, I'm interested in it. Is there some engineering
12 difficulty, or is it simply that when you decided to
13 build your processing plant this became a much more
14 appropriate thing for a common carrier to do than for
15 you to do?

16 A No sir, I think you're
17 taking things out of context here. We arrived at
18 a decision to construct a separate plant rather than
19 to go to Taglu, as had originally been proposed after
20 consideration of a number of alternative schemes.
21 I think that this paragraph that you have read here
22 is part of an overall section in which we have addres-
23 sed ourselves to some of the reasons why we have had
24 this about-face. We have not backed off going to
25 Taglu because we were afraid of building the line.

26 Q I'm not suggesting that
27 your decision to build a processing plant was arrived
28 at because you were afraid to build the line. I'm
29 simply saying that when you decided to build a process-
30 ing plant this line to Taglu became more appropriately

Faulkner & Serra
Cross-Exam by Scott

1 the responsibility of a carrier rather than a processor.

2 A All right, yes, if that's
3 your question I apologize for misunderstanding it. Yes,
4 that's right, we -- once we have made that decision to
5 build a plant at Nig, we are basically producing pipeline
6 quality gas at that gas plant and as with gas plants
7 anywhere else, it is a good and logical point at which
8 to deliver.

9 Q In short, would it be
10 correct to say that you're saying to the applicants,
11 "Look, we're in the processing plant business now too.
12 Pick it up here, not somewhere else."

13 A Yes sir. But I don't
14 think it's quite as arbitrary as that.

15 Q I'm sure it isn't.

16 A You know, I think in
17 plant transmission line situations anywhere, and it
18 can be in the delta or anywhere, there is usually a
19 penalty paid by the producer in the way of a higher
20 tariff or some such thing in order to have the trans-
21 mission line come pick up his gas, and I'm sure that
22 -- well, I better not say "I'm sure", but I anticipate
23 that this will be one of the considerations in the
24 producer, transmission line operator discussions on
25 constructing that line.

26 Q Well then, is it now
27 really correct to say, as I understand you to do in
28 the second sentence, that what turned you off was
29 making these major river crossings?

30 A No sir, that's just one

Faulkner & Serra
Cross-Exam by Scott

1 of the problems, one of the considerations that went
2 into -- well, I'm sorry.

3 Q What I'm getting at,
4 Mr. Faulkner --

5 A No, ^{if} we're talking strictly
6 about the transmission line from Niglintgak to Taglu
7 and who builds and operates it, I think it's a case
8 of who is best at that sort of thing, and who normally
9 does it. Gas transmission is not Shell's business
10 at this point in time, and -- well, I think that's the
11 basic philosophy.

12 Q When you say that there
13 are river crossings -- and I'm summarizing -- that
14 were items of major concern do you really mean that
15 literally, that one should have major concerns about
16 those river crossings, or do you mean to say, "We
17 don't think we should be in the transmission business."

18 A Well, first off we don't
19 want to be in the transmission business, that's a major
20 factor there. The second thing, I think, is that we're
21 talking about two different types of lines here, the
22 hot above-ground line, hot wet above-ground line as
23 opposed to the buried line carrying chilled dry gas.
24 I think that there should definitely be more concerns
25 with operating the former system -- well, yes, basically
26 operating the former system as opposed to the latter.

27 Q So you judged it to be
28 an operational difficulty rather than a construction
29 difficulty. What I'm getting at is, if there are
30 construction difficulties in these river crossings that

Faulkner & Serra
Cross-Exam by Scott

1 you know about, would you tell us about them so we
2 can ask the applicant how they're going to deal with
3 them? If on the other hand it's just that you
4 simply want to be out of the transmission business and
5 you're concerned about operating -- I'm not so concerned
6 then.

7 A Sir, you've got me backed
8 into a bit of a corner and I'm afraid I'm not explaining
9 myself very well. I guess Shell's concern -- well,
10 first of all, I think we're comparing apples and oranges.
11 If it came to pass that Shell had to install that,
12 shall we call it transmission line lateral, and transport
13 finished gas from the Niglintgak plant to whatever
14 tie-in point the transmission line operators wanted
15 us to bring it, we, I think at this point in time, we
16 would be building a below-ground refrigerated system
17 the same as the applicants propose.

18 What we are talking about in
19 this paragraph (a) on page 2-14 is a comparison of
20 different systems. The wet gas system that we would
21 have been operating if we had to take that gas to Taglu
22 for processing, and therefore I think that some of the
23 things that I may have said here in the last few minutes
24 you know, have a combination of those things built
25 into them.

26 MR. SCOTT: Those are all the
27 questions, thank you.

28 MR. BALLEM: I have no re-
29 direct, Mr. Commissioner.

30 THE COMMISSIONER: Then, thank

Scott, Stamberg,
Guyn, Good
In Chief

1 you, Mr. Faulkner and Mr. Serra, for your testimony
2 and for answering questions so patiently put to you
3 by counsel. I think that Mr. Faulkner and Mr. Serra
4 can step down and we can proceed with the next panel.
5 Thank you again, gentlemen.

6 (WITNESSES ASIDE)

7 MR. BALLEM: Mr. Commissioner,
8 I now propose to call a panel consisting of Mr. R.H.
9 Scott, M r. J.C. Stamberg, Mr. Howard T. Guyn, and Mr.
10 William K. Good. These gentlemen have been sworn and
11 they are here to present the prepared testimony of
12 Gulf Oil Canada Limited.

13
14 ROBERT H. SCOTT,
15 JOHN C. STAMBERG,
16 HOWARD T. GUYN,
WILLIAM K. GOOD, sworn:

17 DIRECT EXAMINATION BY MR. BALLEM:

18 Q Mr. Scott, would you
19 please advise the Commission of your full name and your
20 present position with your employer, and your business
21 address, please?

22 WITNESS SCOTT: My name is
23 Robert Howe Scott. I'm manager of the delta project
24 for Gulf Canada in Calgary.

25 Q And sir, would you
26 briefly outline your academic, professional, and business
27 qualifications?

28 A I was educated in
29 Eastern Canada, Dalhousie University, with a Bachelor
30 of Science and a pre-engineering diploma in 1957.
Worked for three years in the Bank of Montreal, prior

Scott, Stamberg, Guyn, Good
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1 to that time, from 1950 to 1953. I joined Gulf Canada,
2 formerly British American Oil Company Limited, in
3 1957. My experience has included a variety of assign-
4 ments with the Marketing Department in Eastern Canada,
5 and the Employee Relations and Exploration and Production
6 Departments in Calgary. Specifically those assignments
7 included industrial marketing representative in the
8 Province of New Brunswick; area marketing representative
9 for three areas in New Brunswick -- St. John, Woodstock,
10 and Moncton; co-ordinator of manpower for the Atlantic
11 Division; marketing, in Halifax, Nova Scotia; I was
12 co-ordinator of employee development in Calgary, Alberta
13 with responsibility for organizing and co-ordinating
14 the implementation of the company's manpower plans for
15 all departments in Western Canada. My current
16 position is manager of the delta project in Calgary,
17 Alberta, and I have responsibility for planning and
18 development of hydrocarbon producing and processing
19 facilities in the Mackenzie Delta.

20 Q Mr. Good, would you
21 please advise the Commission of your position with
22 your employer and your business location?

23 WITNESS GOOD: I am the
24 supervisor of reservoir engineering for Gulf Oil Canada
25 Limited in Calgary, Alberta.

26 Q And sir, would you
27 briefly advise the Commission as to your academic,
28 professional, and business qualifications?

29 A I obtained a Bachelor
30 of Science degree in mechanical engineering from the

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1 University of Alberta in 1963. Following graduation I
2 joined Gulf Canada Limited, formerly the British
3 American Oil Company Limited. Assignments during the
4 initial five years were primarily in the production
5 operations phase. I was transferred to the reservoir
6 engineering staff in 1968, where during this period,
7 1968 to 1974 my assignments consisted of gas reservoir
8 evaluations. I was appointed to my present position
9 of supervisor of reservoir engineering in 1974 and am
10 responsible for oil and gas reservoir evaluations for
11 Gulf Canada. I have testified before the National
12 Energy Board and the Alberta Energy Resources Conserva-
13 tion Board previously.

14 Q Thank you, sir. Mr.
15 Stamberg, would you advise the Commission of your
16 position with your employer and your business location?

17 WITNESS STAMBERG: I am the
18 co-ordinator of development engineering for the delta
19 projects. I am a resident of Calgary.

20 Q And would you advise the
21 Commission of your academic, professional and business
22 qualifications?

23 A I obtained a Bachelor of
24 Science degree in civil engineering from the University
25 of Saskatchewan in 1953, and a certificate in business
26 management from the University of Calgary in 1973. On
27 graduation from the University of Saskatchewan I joined
28 the Production Department of Gulf Oil and worked in
29 field operations in a variety of engineering assignments
30 for two years. For the next eight years I worked in

Scott, Stanberg, Guyn, Good
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1 engineering
2 the mechanical section in the design of oil and gas
3 producing facilities which was primarily associated
4 with the Pincher Creek gas field. In 1963 I was promoted
5 to area engineer in the Stettler office of Gulf Oil, and
6 for two years supervised engineering activities with
7 oil and gas production operations. From 1965 to 1968
8 I was superintendent of the Nevis gas plant. For the
9 next five years I worked in production engineering.
10 This included planning, evaluation, co-ordinating of
11 major installations of both oil and gas facilities in
12 Western Canada. From 1973 to the present I've been
13 co-ordinator of development engineering in Gulf's
14 frontier and the Mackenzie Delta area. This work has
15 included conceptional engineering studies, preliminary
16 engineering, and evaluation work of gas development.
17 I'm a registered professional engineer with the
18 Province of Alberta and have testified before the
19 Energy Resources Conservation Board of Alberta.

20 Q Thank you, sir. Mr. Guyn,
21 would you advise the Board as to your position with your
22 employer and your business location?

23 WITNESS GUYN: My present
24 position is co-ordinator of gas utilization, delta
25 projects, Gulf Oil Canada Limited. I'm located in
26 Calgary, Alberta, Canada.

27 Q And would you, sir, briefly
28 describe to the Board your academic, professional and
29 business qualifications?

30 A I graduated with a Bachelor
of Science degree in petroleum engineering from the

Scott, Stamberg, Guyn, Good
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1 University of Oklahoma in 1957. In joining Gulf Oil
2 Canada in 1957 I worked as a gas engineer at the
3 Pincher Creek gas plant until 1960. From 1960 to '62
4 I was plant engineer of Gulf Oil Canada Rimbey gas
5 plant with responsibilities for direction of engineering
6 through construction start-up and operation. From
7 1962 to '64 I was transferred to the gas engineering
8 position in the Calgary zone office. From 1964 to '67
9 I was operations supervisor, Gulf Oil Canada, Rimbey
10 gas plant, responsible for operating and maintenance
11 functions. From 1967 to 1968 I served as manager
12 of the Gulf Oil Canada Pincher Creek gas plant with
13 responsibility for operating, maintenance and engineering
14 functions. From 1968 to 1974 I was manager of
15 the Gulf Oil Canada Nevis gas plant with responsibility
16 for operating, maintenance and engineering functions.
17 From 1974 to the present time I ^{have} served as co-ordinator
18 of gas utilization, frontier and delta projects in
19 Calgary with responsibility for the planning,
20 engineering, and construction of proposed gas processing
21 facilities in the Mackenzie Delta. I am a registered
22 professional engineer in the Province of Alberta and
23 have testified before the Energy Resources Conservation
24 Board of Alberta.

25 MR. BALLEM:

26 Thank you, Mr. Guyn. Now,
27 Mr. Commissioner, I propose to file as exhibits the
28 prepared evidence submitted by Gulf, together with
29 the Parsons Lake land tenure application material, and
30 I ask that they be so marked.

(QUALIFICATIONS & EVIDENCE OF SCOTT, STAMBERG,
GUYN & GOOD MARKED EXHIBIT 427)

Scott, Stamberg, Guyn, Good
In Chief

1 (PARSONS LAKE DEVELOPMENT LAND TENURE SUBMISSION
2 BY GULF OIL CANADA LIMITED MARKED EXHIBIT 428)

3 MR. BALLEM: Q Mr. Stamberg,
4 would you be good enough to give to the Board the
5 prepared evidence of Gulf Oil Canada?

6 WITNESS STAMBERG: The project
7 description of Gulf Canada's Parsons Lake development.
8 The first section is the summary.

9 Gulf Oil Canada Limited pro-
10 poses to develop an area in the immediate vicinity of
11 Parsons Lake, in the Mackenzie River Delta of the
12 Northwest Territories for the purpose of producing
13 natural gas and processing that gas to meet pipeline
14 specifications. The plan calls for the processing
15 plant to be on-stream by mid-1981, coinciding with the
16 proposed completion of ^{the} Canadian Arctic Gas Pipeline.
17 To meet this completion schedule, Gulf is currently
18 drilling wells in the Parsons Lake area.

19 Natural gas and liquids will
20 be produced through development wells, then transported
21 in heat-traced pipelines to a central gas processing
22 facility located near the Parsons Lake field about two
23 miles east and a little south of Parsons Lake. The
24 Parsons Lake plant will separate the gas for transmis-
25 sion by removing water, hydrocarbon liquids, and
26 possibly carbon dioxide.

27 An airstrip, probably STOL,
28 will be built adjacent to the plant, and a road will
29 interconnect the producing wells, plant, airstrip and
30 dock area, and also the gravel source for building

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1 materials.

2 A proposed step by step develop-
3 ment of the Parsons Lake area over the next six years
4 is shown on the screen.

5 II. Reserves. Six wells in
6 the Parsons Lake area have encountered natural gas in a
7 number of sands located at a depth of 6,600 feet and in
8 the interval 8,500 feet to 10,000 feet. From the data
9 currently available, Gulf Oil Canada Limited estimates
10 that the proven recoverable marketable gas reserves are
11 690 BCF. Additional reserves considered probable are
12 710 BCF and a further 1,676 BCF are considered possible.

13 Q Excuse me, Mr. Stamberg.
14 I believe you might have misquoted ^{yourself} in connection with
15 the proven. You said 690. Is that correct, or is it
16 590?

17 A 590, I'm sorry.

18 Q Thank you, sir.

19 A The total possible reser-
20 ves in the area is estimated to be 2,976 BCF. Data from
21 future drilling in the area is expected to increase the
22 proven reserves and will result in changes in the esti-
23 mates of probable and possible reserves.

24 The production rate and number
25 of wells required to produce the reserves are dependent
26 on the best estimate of these reserves. It is expected,
27 however, that 12 wells will be produced and that the
28 average will be capable of producing approximately
29 30 to 50 million cubic feet per day per well. The
30 operational life of the field is estimated to be in

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1 excess of 20 years.

2 III. Drilling and completion.

3 Development wells in the Parsons Lake field will be
4 drilled from a number of surface locations identified
5 as cluster pads. Two to four wells will be drilled on
6 each pad. Depending mainly on the success of the 1975-
7 76 winter drilling program, up to six cluster pads are
8 anticipated.

9 Because of the extensive and
10 complex system of geological faults in Parsons Lake,
11 the number of wells that can be satisfactorily drilled
12 to drain the reservoir is limited to a maximum of
13 about four per cluster. Wells will be directionally
14 drilled to a maximum horizontal deviation of about
15 one mile. Current information indicates that a total
16 of 12 wells -- 12 development wells would be required,
17 of which four will be drilled this winter. Further
18 development will depend on the success of this program,
19 but would probably begin in the 1978-79 winter season
20 and continue for about three years.

21 In addition to the development
22 wells, two disposal wells will be drilled near the
23 processing plant. One will receive surplus hydro-
24 carbons from the plant; and the other will receive
25 waste water.

26 For the development program
27 an existing rig will be converted to handle both
28 drilling and completion work. The rig will have the
29 same precautionary blowout prevention equipment as
30 used for exploration drilling. Modifications will

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1 consist of a skidding system to enable the rig to
2 be moved as quickly as possible from one location to
3 another on the cluster pad. Wells will be spaced at
4 about 100-foot intervals in a straight line on each
5 cluster. A connecting road will allow the rig to be
6 moved between cluster pads.

7 on the screen
Figure 3.0/shows hole design
8 for directional wells. A water base calcium chloride
9 mud system is planned. Equipment and supplies for
10 development drilling would be stocked at Gulf's
11 Swimming Point base camp. When dock and road facilities
12 are completed at Hans Bay, drilling supplies will then
13 be barged around the Tuktoyaktuk Peninsula, through
14 the Eskimo Lakes to Hans Bay, and then directly to the
15 drilling sites. About 20 Series 1,500 barges will be
16 needed to carry mud, cement, diesel and casing for 12
17 wells, during a development period of about three years.

18 If only two development wells
19 are to be drilled on a single cluster pad, an open
20 sump system is planned. These wells will be drilled
21 only during winter months and a sump will be built for
22 each. Disposal will consist of allowing the sump to
23 freeze, then backfilling it with gravel and fill. If
24 more than two wells are planned, drilling will go on
25 all year. A single sump will serve all clusters or all
26 wells on the cluster, and a disposal well will be
27 drilled to receive drilling fluids.

28 Well completion will include
29 running an insulated casing string, or other suitable
30 insulation such as gelled diesel, to limit thermal

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1 disturbance and prevent surface slumping and abnormal
2 stresses on the casing strings. Production tubing and
3 bottom-hole safety valves will then be run; the well
4 will be perforated, possibly stimulated, and production
5 tested.

6 Field facilities. Clusters.

7 A gravel pad approximately 400 x 600 and up to seven
8 feet in thickness will accommodate the drilling operation
9 for up to four wells and will support the permanent
10 producing facilities. These facilities will include well
11 test manifold, flare system, test separator, metering
12 facilities, storage tanks, emergency power, emergency
13 shelter, and remote terminal unit for the computer
14 control system. All this equipment except the flare
15 system and storage tanks will be prefabricated modules
16 completely housed and insulated. The entire producing
17 facility will occupy only a small portion of each
18 cluster pad.

19 When all wells have been
20 completed, the rig will be dismantled and removed from
21 the cluster. The production facilities described
22 will then be installed and the cluster made ready for
23 producing operations.

24 Gathering system. Production
25 from each cluster will be conveyed by pipeline to the
26 main gas processing plant. The pipeline will be above
27 ground on piling supports, and will be insulated and
28 electrically heat-traced.

29 Normal pipeline operating
30 pressure will be controlled to accommodate a plant inlet

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1 pressure of 1,100 psig., and will never exceed the
2 design rate of 1,440 psig. An all-weather road system
3 and a high-voltage power line will be built within the
4 pipeline right -of-way and the road will provide an
5 access to and from the cluster site. The power line
6 will transmit electrical energy to all utilities at the
7 cluster.

8 Computer control system. The
9 gas production and processing facilities must operate
10 safely and continuously in a hostile climate, with
11 minimum impact on the environment. The system there-
12 fore must be highly automated and extremely reliable.

13 A terminal unit at each cluster
14 and at the gas processing plant will communicate with
15 a master unit at the plant operations centre. The
16 terminal unit will interface with the cluster process
17 and devices, and will provide for the basic functions
18 of alarm detection, status checking, measurement and
19 control.

20 The master terminal unit at
21 the operations centre will be capable of analyzing the
22 data gathered by the remote units as well as perform-
23 ing complex functions for each cluster, such as
24 automatic well testing, pipeline leak detection, alarm
25 message display, and implementation of corrective
26 action, trend analysis, operator over-ride, and
27 audit. It also will be able to provide optimization
28 control for the gas processing plant. Two computers
29 will be incorporated into the master terminal -- one to
30 serve as backup in the event the first should fail.

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1 All the remote terminal units
2 will be designed so they could maintain control at a
3 cluster or within the gas plant in the event of a
4 communications failure.

5 V. Gas processing plant.

6 The plant will be designed to process a minimum of
7 150 million cubic feet a day of raw gas and will
8 probably handle 300 million cubic feet a day in two
9 parallel processing trains. The ultimate plant capacity,
10 however, will depend on the success of the current
11 1975-76 drilling program. Composition of the raw gas
12 which does not contain any sulphur compounds, are
13 shown in figure 1.

14 The preparation of the raw
15 gas involves the following operations:

- 16 1. Separation of the raw gas into gas and liquid
17 (hydrocarbon and free water) phases at the separation
18 pressure and temperature conditions of 1,100 psig. and
19 85 degrees Fahrenheit. The water recovered will be
20 injected into a suitable underground formation.
- 21 2. Removal of saturated water in the gas to minimal
22 amounts by means of glycol absorption or solid dessicant
23 bed absorption. The removal of saturation water is
24 necessary to prevent the possibility of gas freezing
25 in the transmission line or market distribution lines,
26 and also to minimize the possibility of corrosion, which
27 is enhanced by the presence of water.
- 28 3. Removal of heavier hydrocarbons that could condense
29 to a liquid in the transmission line at its operating
30 pressure and temperature. Compression equipment on the

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1 transmission line at various points cannot withstand
2 any liquid, and in addition liquid in the line adds
3 dramatically to the pressure drop and thus reduces the
4 capacity of the line.

5 Removal of heavier hydrocarbons
6 will be carried out by propane refrigeration whereby
7 the gas is cooled and the heavier hydrocarbons are
8 condensed to a liquid state for removal from the gas
9 stream. If a liquid topping plant is to be utilized,
10 these liquid hydrocarbons will be utilized as feed for
11 the production of diesel and naphtha. If a topping
12 plant is not installed, the recovered liquids will be
13 returned to the producing formations.

14 4. Carbon dioxide may be removed because gas purchas-
15 ers and transmission firms specify a maximum limit of
16 carbon dioxide. Also, the lower the carbon dioxide
17 content, the higher the heating value of the sales
18 gas. The carbon dioxide is not a physical problem
19 as far as handling is concerned because it has no heat-
20 ing value, transporting it is a wasteful use of energy
21 and pipeline capacity. If the removal of carbon
22 dioxide proves to be feasible, it would be accomplished
23 by the use of chemical liquid absorption. Small volumes
24 of non-toxic carbon dioxide would be vented to the
25 atmosphere and should present no problem.

26 5. Flaring of the gas from the plant will be limited
27 to startup and shut-down and to emergency conditions.
28 Design of the system will allow for the minimizing
29 effects of radiant heat on the permafrost. Liquid
30 flaring will be limited by a recovery system which

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1 will return the liquids to the plant. Plant control
2 and emergency shut-down systems will provide for
3 expedient reduction of gas production and thus limit
4 flare volumes to a practical minimum.

5 After the gas has been treated
6 to meet water and hydrocarbon specifications, it will
7 be decompressed to the required delivery pressure of
8 1,680 psig. and cooled by propane refrigeration to meet
9 the required maximum delivery temperature of 25 degrees
10 Fahrenheit.

11 Equipment associated with
12 the plant process and its support facilities will include
13 separation and distillation vessels, turbine driven
14 gas and refrigerant compressors, heat exchangers,
15 pumps, electric and diesel engine driven oil compressors,
16 and turbine driven electric generators. The electric
17 generators will generate sufficient electricity to
18 operate all project facilities. All process equipment
19 and buildings will be constructed on pilings to ensure
20 protection of the permafrost.

21 Storage facilities for the
22 various gas process fluids will be located an approp-
23 riate distance from the process facilities, and all
24 liquid storage tanks will be enclosed by dykes to
25 contain any spills or leaks.

26 Water treatment will be neces-
27 sary to ensure a continuous supply of fresh water.
28 This facility will be designed for use in both con-
29 struction and operating phases. Several possible
30 sources of water have been surveyed. They include Parsons

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1 Lake, Hans Bay and a small source near the plant.

2 Waste handling. A sewage
3 disposal system will be installed near the living quar-
4 ters complex to handle all sewage from that source,
5 as well as the gas plant washroom facilities, and
6 temporary facilities in areas away from the plant.

7 The system will include sufficient treating capability to
8 bring both the bio oxygen demand and suspended solids
9 concentration levels of the effluent down to 15 parts
10 per million, and to meet any other standards that
11 may be set by the governmental authority before dis-
12 charge to the environment.

13 Anticipated sewage rates
14 would be 8,000 gallons per day during peak construction
15 and 2,000 gallons per day during operation. We will
16 also alleviate the feasibility of combining partially
17 treated sewage with process waste water from the
18 plant -- we will also evaluate, excuse me, the feasi-
19 bility of combining partially treated sewage with
20 process waste water from the plant, then injecting
21 the total effluent into a suitable disposal well.

22 A sewage handling system also
23 will be installed at each well cluster and at the
24 dock site to deal with any wastes originating from
25 those points.

26 Aqueous effluents. At this
27 time the Parsons Lake plant is not expected to need
28 continuous amounts of process water. The small amount
29 that will be needed, along with any water produced
30 by the process, will be treated and injected through

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1 a disposal well to a suitable underground formation.

2 Liquid wastes originating from
3 the washroom laundries and kitchen facilities will
4 undergo secondary treatment to provide water acceptable
5 for discharge to nearby receiving waters. An appropri-
6 ate treatment system will be designed for this pur-
7 pose and the quality of discharged effluents will be
8 monitored regularly.

9 Waste solids, or waste
10 treatment. An incineration system will burn refuse
11 from the camp and waste sludge produced by the sewage
12 treatment plant. The ashes will then be buried in a
13 designated landfill site, along with waste materials
14 that cannot be incinerated.

15 VI. Support facilities.

16 Preconstruction activities. Preliminary work such as
17 site surveys and geotechnical work will be carried
18 out before construction of the producing and processing
19 facilities is started. Location of all facilities,
20 including roads, gathering systems, well clusters,
21 dock and the airstrip will be established. The few
22 personnel required will be accommodated in a small
23 portable camp or in existing drilling camps. Surveying
24 will be carried out both in the summer and winter, and
25 will be supported by helicopter, fixed-wing aircraft,
26 ground vehicles and boats. As mentioned previously, a
27 dock for off-loading equipment and materials is proposed
28 on Hans Bay.

29 Geotechnical activity. A
30 preliminary geotechnical survey to determine soil

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1 conditions and quality is almost complete. Geotechnical
2 data were obtained in three areas in the Parsons Lake
3 field to determine a suitable location for the gas
4 processing plant.

5 One area lacks natural drain-
6 age, and the soil has a high moisture and ice content.
7 The second area considered, although geotechnically
8 satisfactory, is remote from the docksite and gravel
9 source, and is not centrally located with respect to
10 the proposed producing well clusters. The third area
11 considered was selected for the following reasons:

12 It is closest to the proposed dock site on
13 Hans Bay.

14 An airstrip could be located nearby.

15 It is close to gravel pits.

16 And finally, soil and foundation conditions are
17 good for plant construction.

18 The location of the plant
19 and other facilities in the Parsons Lake area are
20 shown on the screen.

21 MR. BAYLY: It's difficult
22 to hear.

23 A Roads, dock and airstrip.
24 An all-weather service road will connect the
25 producing facilities and the process plant to the air-
26 strip and gravel supply. Service roads will be 20 foot
27 wide, built of compacted pit run gravel six foot thick.
28 A transporter road designed to carry heavy modules
29 will connect the dock and the plant site. This road
30 will be 35 foot wide and have about a 7-foot thickness

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1 of gravel. About 20 miles in total of service roads
2 and 1½ miles of transporter road will be built.

3 The heavier plant modules
4 and other construction materials and equipment will be
5 moved into the Parsons Lake area through Eskimo Lakes
6 and Hans Bay to the plant site. A dock and staging
7 area of approximately 500 feet by 700 feet will be
8 built on the north shore of Hans Bay. The dock will be
9 built of sheet piling driven into the bottom of the
10 bay, and backfilled with gravel. A gravel staging
11 pad will be built on shore adjacent to the dock for
12 temporary storage of modules and materials.

13 An air strip, probably a
14 STOL strip, will be required to accommodate small
15 aircraft and will transport personnel and light
16 freight on a year-around basis. The proposed airstrip
17 will be about 200 feet wide by 2,500 to 3,000 feet
18 long, and will be built of gravel of approximately eight
19 feet thick. The strip will be located about one mile
20 north-east of the plant site and connected to the
21 plant by a service road.

22 Accommodation. Initially,
23 20 to 30 people will be accommodated in a modularized
24 skid-type camp located near the gravel source, about
25 two miles south of the plant site. This type of tem-
26 porary accommodation will be set up during the summer
27 of 1977 and used at the gravel pit until probably mid-
28 1978. In the peak construction period, a main camp
29 probably will house about 200 people. Optimum use of
30 utilities demands one large camp, because it is more

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1 economical, more convenient and safer than seasonal
2 smaller camps scattered throughout the operations area.

3 Design of the temporary
4 accommodations will utilize modular construction through-
5 out. The camp units will be moved to the construction
6 area and connected to form common unitized accommoda-
7 tions, when the plant construction begins. Part of the
8 construction camp will be incorporated into the perman-
9 ent accommodations, the remainder will be removed from
10 the site.

11 Camp services will include a
12 well-equipped emergency medical facility staffed on a
13 24-hour basis, by experienced people. Recreational
14 space and facilities such as T.V., radio, movies,
15 game rooms and reading and writing material will be
16 supplied. Rooms probably will be semi-private; that is
17 two people to a room. Food and meals will be supplied
18 by a private catering firm.

19 Permanent accommodations at
20 the plant site will be modular design and will provide
21 the same services as the temporary accommodations. It
22 will be smaller, however, to house about 50 permanent
23 people who will be responsible for the operation and
24 maintenance of the plant, wells and gathering system.

25 Warehouse and maintenance
26 shops. A heated warehouse to house spare parts and
27 servicing facilities for construction will be built on
28 the plant site, probably during the summer of 1978.
29 The maintenance shop will carry a full line of tools,
30 machinery and maintenance materials to service heavy

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1 moving equipment such as bulldozers, scrapers and
2 trucks.

3 VII. Transportation and
4 construction. Personnel, consumables, small light
5 materials and equipment will be transported into
6 Parsons Lake area by aircraft on a year-around
7 basis. Heavy, bulky, large equipment will be moved by
8 barge. The largest plant modules probably will be
9 barged north around Alaska and through the Eskimo Lakes
10 to Hans Bay, then moved over the specially designed
11 transporter road to the plant site. Smaller modules
12 and freight will be moved by rail to Hay River, then
13 by barge down the Mackenzie River into the Eskimo Lakes
14 and finally to Hans Bay. Other construction equipment,
15 spare parts, supplies, etc., probably will be moved
16 down the Mackenzie River from June to September, stored
17 in staging areas at Lucas Point until freeze-up, then
18 moved over a winter road to the Parsons Lake area.

19 In the Parsons Lake area local
20 transportation in summer will be by boat, barge,
21 helicopter and fixed wing aircraft. Conventional
22 vehicles will be used on all-weather roads during
23 summer, and also on snow roads after freeze-up.

24 Construction in various
25 phases will proceed all year around. Most of the heavy
26 construction on projects such as roads, pads, dock,
27 airstrips and gathering system will proceed actively
28 in summer and more slowly in winter. The plant itself,
29 the camp, and producing cluster facilities will take
30 advantage of the modularized construction technique for

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1 year-around installation.

2 MR. BALLEM: Thank you, Mr.
3 Stamberg. Mr. Commissioner, these witnesses are avail-
4 able for cross-examination. I note that we have four
5 witnesses and only two microphones, so I'm going to
6 caution them if they would, be very sure that they
7 have a microphone in front of them when they are
8 replying.

9 THE COMMISSIONER: Thank you,
10 Mr. Ballem.

11 Mr. Stamberg, what in round
12 numbers is the capital cost of the Gulf Parsons Lake
13 gas development project likely to be?

14 A We think the facility --
15 and this is assuming that we would build a 300-man
16 capacity plant, will cost in the neighborhood of
17 \$300 million, and that's expressed in current dollars.
18 That is a rough estimate, sir. We have not done
19 detailed engineering to fully evaluate those costs.

20 THE COMMISSIONER: All right,
21 well let's adjourn for coffee then and come back.

22 (PROCEEDINGS ADJOURNED FOR A FEW MINUTES)
23
24
25
26
27
28
29
30

Marshall.

MR. HOLLINGWORTH: Prior to commencing cross-examination sir, at Mr. Bayly's request this morning concerned operating pressure in utility lines within towns, and I have been advised as follows, with respect to the Foothills system and I gather that these would be similar to ones in the south. That the nominal operating pressure in the Mackenzie Valley would be 1250 PSI, In most cases gas moving into the Mackenzie Valley laterals would be at approximately 1000 PSI being downstream from the compressor stations. On the Yellowknife Pine Point lateral this would be more like 600-800 PSI. At town gates, this pressure is stepped down to a licensed pressure of 60 PSI and it might run more like 30-50 PSI, and at the outlet into a regular, that is to

1 say into a typical house, it would be further reduced to
2 pressure necessary, it's called a seven inch water column
3 pressure, which I understand is pressure required to lift
4 the column ^{of water} seven inches, if I'm not mistaken.

5 THE COMMISSIONER: Sorry, could
6 you speak up a bit, I didn't quite hear you.

7 MR. HOLLINGWORTH: It's reduced
8 to, what is called a seven inch water column pressure,
9 which I understand is the pressure required to lift a
10 water column seven inches, but I'm not sure on that but
11 anyway it works out to being a fraction of the PSI and
12 as I say this apparently compares to the usual operations
13 of utilities in the south.

14 MR. BAYLY: Thank you Mr. Holl-
15 ingworth for this information.

16 MR. HOLLINGWORTH: Gentlemen,
17 in connection with your sewage treatment proposed at
18 Parsons Lake, have you worked out a final design or even
19 a proposed design on this at all, or are you still look-
20 ing at various systems.

21 WITNESS STAMBERG: No, we have
22 not looked at a design other than a very preliminary design.

23 MR. HOLLINGWORTH: I'm sorry sir,
24 I__

25 WITNESS STAMBERG: Only a very
26 preliminary design to date.

27 Q And you're not certain at this
28 time what system you are going to be employing at Parsons?

29 A That is correct.

30 Q Now, have you any figure

1 or even an estimate as to the total tonnage of materials
2 that will be required to construct the Parsons Lake gas
3 plant including the tonnages for the construction equip-
4 ment, the gathering lines, and the well drilling?

5 A We've not got detailed es-
6 timates on these tonnages, Mr. Hollingworth; we've heard
7 your questions to Imperial and Shell and have prepared
8 very rough approximations of what we see these tonnages
9 at. In our land tenure submission, we refer to our
10 drilling tonnage as being about 56 hundred tons per well,
11 or based on about 16 wells, I think some 20 thousand
12 tons of drilling supplies.

13 As far as gathering system and
14 gathering site construction, we guess that could be about
15 10 thousand tons, and the process plant equipment, includ-
16 ing the camp construction, or the operations camp to be
17 about 30 thousand tons. A total of about 60 thousand
18 tons. I would urge, or would stress that these are very
19 gross approximations.

20 Q Would you give us. Sorry
21 go ahead.

22 A They are based on a facil-
23 ity of about 150 million cubic feet a day.

24 Q But earlier, in your answer
25 to the Commissioner, you estimated the cost ^{based} on a through
26 put of 300 million cubic feet a day. Did I hear you
27 correctly at that time?

28 A Yes. That's right.

29 Q Well, would you see a
30 great increase in tonnage, in the event that you opted

1 for the 300 million cubic foot system?

2 A There would be an increase.

3 I don't know how much.

4 Q If I can just run back over
5 those figures, I believe I heard you to say 56 hundred
6 tons per well?

7 A 57 hundred tons per. Par-
8 don me, 57 hundred tons for four wells, and based on a
9 total of 16 wells I simply multiplied that by four to
10 come ^{up} with about 20 thousand tons.

11 Q That makes better arith-
12 metic. Now, which route do you plan to use in order to
13 get this material from the south to Parsons Lake?

14 A We haven't resolved that.

15 Q You haven't even, have you
16 investigated using the ocean route that the other two
17 producers are speaking of using for part of their mat-
18 erial?

19 A Only on a very preliminary
20 nature.

21 Q And I guess it would follow
22 from that then that you haven't gone any further in your
23 investigations of using the Mackenzie River tug system.

24 A No.

25 Q Then you haven't entered
26 into discussions with Northern Transportation and the
27 other pipe companies?

28 A No sir.

29 Q What about the amount of
30 fuel you would use during construction? Have you any
estimate for that?

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A Mr. Guyn can answer that.

WITNESS GUYN: We would estimate in the order of 250 thousand tons, or barrels I should say, I'm sorry.

MR. HOLLINGWORTH:

Thank you gentlemen.

THE COMMISSIONER: Mr. Bayly?

CROSS EXAMINATION BY MR. BAYLY:

Q I think I'll start as I have done in the past where Mr. Hollingworth has left off. Have you examined the Mackenzie River system to determine whether you would use Hay River or Fort Simpson as your major staging area for off-loading equipment and materials for barging.

WITNESS STAMBERG: I'll turn that over to Mr. Scott please.

WITNESS SCOTT: I think the three producers and the pipeline company will have to examine all of the transportation systems, and we have taken steps to start on that one. First of all, determine the capacity of the system, the constraints that are on it now, and what we might need, and it's just at that stage. We have not gone beyond determining what we want to know out of it.

Q How long will that take you Mr. Scott.

A I don't know, I would think several months.

Q So that would be by the summer of 1976 you would have an idea of the capacity of the existing system and its ability to take on the

1 loads of the various developments associated with this
2 entire project.

3 A We would have some ideas
4 but I would think that in addition to that we will have
5 to know some of our design concepts to see which way we
6 might want to go.

7 Q And if it does turn out
8 that it takes two years to order barges, will you be in
9 a position to move stuff down the river on additional
10 barges at the time that you'd like to start moving equip-
11 ment?

12 A I don't know sir.

13 Q So it may be that your
14 construction schedule will have to be delayed because
15 you haven't got to this stage in your logistics planning.

16 A Certainly if there is not
17 the capabilities of transport, yes, it would have to be
18 delayed.

19 Q And you appreciate the con-
20 cern I expressed to the other two petroleum companies
21 that the people in this area are worried that the capa-
22 city that you have may take up barge space that they re-
23 quire for their yearly supplies.

24 A I appreciate the concern
25 and we would share that concern and would think the needs
26 of the community should have priority.

27 Q All right. And you would
28 be prepared to enter into an agreement with the carriers
29 to ensure that the communities would have priority if
30 there weren't enough carrying space for both your project

1 and their needs?

2 A I'm not sure that would
3 be our, either our responsibility or our requirement.

4 Q I'm not suggesting its
5 either your responsibility or a requirement, but if you
6 appreciate the problem, would your company be prepared to
7 make that commitment voluntarily?

8 A And what was the commit-
9 ment you suggested again?

10 Q That is to ensure that
11 communities would be supplied as they have been by the
12 barging system before you took up the remaining space on
13 the barges.

14 A I would think so, yes.

15 Q Now, if I could turn to
16 page three of your evidence, you talk about ^{what I will classify as} the total
17 development plan. Now you're talking about first of all
18 two to four wells per pad, and that's a variation of 100%
19 if two is the minimum and four is the maximum. What will
20 determine that?

21 WITNESS STAMBERG: The nature
22 of the reservoir I think would be the primary factor.
23 The faulting system in the reservoir would be the main
24 factor. It would determine the number of directional
25 wells that we could drill from a single cluster pad.

26 Q All right, so you haven't
27 yet determined how many you can drill from each cluster
28 pad because your knowledge of the formations is not at
29 that stage. Is that correct?

30 A That's correct.

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1 Q Now would that mean that
2 we might see six cluster pads of two wells, or are we
3 looking at a total of 24 wells, either on twelve pads
4 or six pads?

5 A We have estimated that
6 there would be a total of twelve wells. Twelve produc-
7 ing wells.

8 Q I understand that but you
9 also talk about a drilling program, using up to six
10 cluster pads. Now you would only use six cluster pads
11 if the formation was such that you could only put two
12 wells per pad. Is that the way I should understand that
13 evidence?

14 A Yes. I think so.

15 Q So you think it's, your
16 saying that this evidence does not permit the interpre-
17 tation that there may be twenty-four wells.

18 A That's right. To our
19 knowledge right now, we don't anticipate twenty-four wells.

20 Q So you would only have
21 three cluster pads if you drilled four wells per pad?
22 Is that correct?

23 A That's right.

24 Q And is there room for var-
25 iation in between those two alternatives? Are those the
26 only two possibilities? I see Mr. Good shaking his
27 head. Would you like to comment on that question sir.

28 WITNESS GOOD: Yes, as mentioned
29 the subject of the number of wells and the clusters and
30 the location of clusters, depends on the configuration

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Cross-Exam by Bayly

1 of the reservoir and there would be room between those
2 two, there could be a possible alternative between
3 them is what I'm saying.

4 Q All right.

5 A Depending on the reservoir.

6 Q There could be four
7 clusters with three wells.

8 A Conceivably there could,
9 yes.

10 Q All right, or a pad with
11 four and a couple of pads with two each.

12 A Yes.

13 Q But at the moment the
14 way you see the reservoir, we're not looking at the
15 possibility of any more than 12 wells.

16 A No, we aren't.

17 Q Now these figures, can
18 you indicate whether they refer only to the initial
19 production phase, or do you see this as referring to
20 total production from this field over the 20-year
21 projected life of the field?

22 A It's the total production
23 over the 20 years.

24 Q And I suppose the only
25 thing that might vary that is if you brought gas in
26 by way of a feeder system from some area off the
27 thousand acres or so that you anticipate using for
28 processing either your own gas well or one of the
29 other company's gas wells.

30 A Are you speaking of the

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1 Parsons Lake project now, or some project outside of
2 the Parsons Lake?

3 Q I'm talking about the
4 possibility that we will see the Parsons Lake gas plant
5 processing gas outside the area that you've projected
6 in this development proposal.

7 WITNESS SCOTT: We don't have
8 any plans for that at this time.

9 Q All right, now we did
10 hear from Shell this morning that there is the possi-
11 bility that gas would be found across the channel
12 from them would have to be processed somewhere else
13 if it were to be exploited. Do you see the possibility
14 not necessarily of that particular well, but of other
15 wells outside your own holdings requesting permission
16 to process gas at the plant you will be constructing
17 at Parsons Lake?

18 WITNESS STAMBERG: That's
19 a possibility, but it doesn't appear to be a very
20 real possibility to us at this time.

21 Q A real possibility at
22 this time, what does that mean in --

23 A We don't know.

24 WITNESS SCOTT: If I can add.
25 we do not know of any gas at this time that would be
26 brought and processed.

27 Q But you can't say that
28 within the 20-year projected life of this particular
29 reservoir that it won't happen.

30 A Right.

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1 Q In fact you hope it will in
2 some ways.

3 A I. A > A We would
4 hope it would.

5 Q If we turn to your big
6 white volume at 2.36, that's page 2.36, item 2.33,
7 there's a statement there:

8 "The number of development wells required to
9 drain the Parsons Lake reserves has not so far
10 been established mainly because of the extents
11 of incomplex faulting system in the area."

12 Do you still say that that statement combined with
13 what you've said in your evidence limits the number of
14 production wells to 12?

15 WITNESS GOOD: I believe it does.
16 Admittedly,
17 it is quite a complex area from the standpoint of
18 faulting, but the way we see the area and considering
19 the total reserves in the area we believe it can be
20 effectively drained by 12 wells.

21 Q Does that mean that your
22 1975-1976 drilling season has been completed to enough
23 of an extent to allow you to determine the number of
24 wells, or are you still looking for information from
25 that program before you could give me an answer that
26 you could be completely confident of?

27 A The main purpose of
28 the current drilling program is to prove up reserves
29 in this pool, that is to provide us with confidence
30 of the amount of gas there that could support the
proposed facility. When we speak of 12 wells, we're

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1 considering what in our estimate is the total probable
2 reserves in this pool, which are being developed by
3 the current drilling.

4 Q Isn't, though, the size
5 of the reserve very important in determining how many
6 wells you're going to have so that you can keep up
7 constant production? That appeared to be what we
8 learned from Mr. Horsfield on Monday or Tuesday.

9 A That's right, it is.

10 Q So if they doubled the
11 amount of gas in your most optimistic forecast, then
12 you might have more than 12 wells. Would that be fair
13 to say?

14 WITNESS STAMBERG: It certainly would.

15 Q We're back into the "if-y"
16 game because you haven't established the size of the
17 reservoir and won't for a period of time. You won't
18 have that information for a period of time.

19 A That's right.

20 Q Now, what I'm concerned
21 with as a point perhaps just of confusion, is at the
22 bottom of page 12. You talk about having a single
23 camp rather than seasonal smaller camps scattered
24 throughout the operations area. Now does that contem-
25 plate an operations area of larger than 1,000 acres?

26 A No.

27 Q Because it strikes me
28 that if all you've got is what is essentially two
29 square miles, that the idea of scattering camps over
30 that area doesn't look like it would be a problem that

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1 at it during ice fog periods.

2 A I believe that this
3 was taken into consideration in the distance that the
4 strip is located.

5 Q Well, let's have a look
6 at that because it doesn't look to me like it's four
7 miles away from the plant.

8 A Well --

9 Q It would have to be a
10 two-mile radius away in order to escape the conditions
11 that Imperial has projected as happening at least once
12 during the months of January and February, and just
13 taking your scale it appears to be a little over
14 one mile from the plant to the airstrip. Do you agree
15 with that?

16 A There are other factors
17 involved -- climatic conditions, wind conditions, and
18 so on, and that's really the reason I don't want to
19 get into the specifics because I feel they can dis-
20 cuss this better.

21 Q So they having been
22 alerted will be able to address themselves to this
23 problem.

24 A Right.

25 WITNESS SCOTT: If I could
26 comment there, that the size of the two plants is
27 significantly different and that might have a bearing
28 on the size of the -- or the diameter of the ice fog.

29 MR. MARSHALL: Well, Mr.
30 Bayly, since this will be coming up later and I'd

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1 rather like to follow it, whether you're talking about
2 Imperial Oil evidence as to what's going to happen at
3 their plant, their evidence as to what's going to happen
4 at Gulf's plant? Perhaps if you could give a reference
5 we'd be able to follow that more closely.

6 MR. BAYLY: It's in the big
7 green book and the page is -- I'll look up the page
8 reference and I'll give that to Mr. Marshall when
9 it's been found.

10 MR. MARSHALL: Thank you.

11 MR. BAYLY: But I am referring,
12 Mr. Commissioner, to Imperial's estimates of the ice
13 fog created in their own area rather than any comments
14 that they would make about Gulf's plant. They aren't
15 found in the big green book.

16 Q Would you anticipate that
17 jet planes would be landing at the Parsons Lake strip
18 if it were decided to have a 6,000 instead of a 2,500
19 foot strip?

20 WITNESS STAMBERG: Yes.

21 Q What sort of criteria
22 go into the determination of whether you will opt for
23 a 2,500 or a 6,000-foot strip in your final application?

24 A The volumes of traffic
25 and movement of goods by air both during construction
26 and operation as opposed to the cost of building a
27 STOL strip versus a jet strip, I think are the main
28 factors that enter that balance. By that I am including
29 and recognizing the scarcity of gravel.

30 Q So the supply of gravel

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1 may have something to do with it.

2 A Yes, it might.

3 Q And the transportation
4 logistics either those that you opt for or those that
5 are imposed upon you, by regulation.

6 A I don't understand what
7 you mean.

8 Q Well, let's take for
9 an example -- and I'll get back into this a little
10 later -- but let's take for an example that you might
11 be not allowed to run barges in through the Husky Lakes.
12 That hasn't been determined yet, I understand. If
13 you accept for the moment that you wouldn't be allowed,
14 then you might want to have a longer airstrip because
15 you might want to bring more material in by air.

16 A That's a possibility,
17 under those circumstances, yes.

18 Q And what I'm interested
19 in is what things have to be decided before you can
20 decide what kind of airstrip you're going to need.

21 A I've given you my
22 opinion of what those things are, I believe.

23 Q All right, when will you
24 know about this decision?

25 A I would estimate in the
26 late fall.

27 Q Of this year?

28 A Yes.

29 MR. BAYLY: Mr. Commissioner,
30 in the big green book is 3-24, 3-26.

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 Q With regard to the storage
2 of fluids, you speak about the storage facilities being
3 an appropriate distance from the facilities. How do
4 you determine what's an appropriate distance from the
5 facilities?

6 A Mr. Guyn?

7 WITNESS GUYN: The distance
8 has not been decided at this time. It will be in the
9 engineering to be performed over the next year. As to
10 what is an appropriate distance, this would relate
11 primarily to a safety factor. I believe that would be
12 the prime determining factor.

13 Q Now that's safety of the
14 plant and safety to personnel?

15 A It could be both.

16 Q What about safety to
17 the environment?

18 A Not really. In what
19 respect are you asking?

20 Q Well, I gather you're
21 going to store fluids in liquid storage tanks and
22 you're going to surround them by dykes, and the dykes,
23 I assume, are to keep the fluids in rather than people
24 or anything else out.

25 A That's right.

26 Q Because you don't have
27 the problem that the other producers have of locating
28 close to a river, and you want them an appropriate
29 distance from your facility and I assume that includes
30 docks as well as processing plants, and I'm just

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Cross-Exam by Bayly

1 suggesting to you that one of the reasons may be to
2 protect the environment as well as to protect the plant
3 and the personnel; but that may not be the case? Don't
4 let me bully you.

5 A No, I would say the
6 dykes would serve to protect the environment in the
7 case of leakage from the inside.

8 Q Now, you've said that
9 the dykes will protect from leakage. How do you
10 determine how big to build the walls of the dyke?

11 A Oh, I believe one rule
12 of thumb is that it would be determined by large
13 enough to contain the total volume of the fluids that
14 are in your storage tanks.

15 Q And would you have to
16 include in that the volume of any water that had
17 fallen as rain and the volume of any snow and ice
18 that had accumulated during the wintertime?

19 A You really should not
20 try and allow water to be contained in the dykes. You
21 should try and drain that away.

22 Q All right, you can't
23 always do that, I take it. If a failure of one of
24 these storage tanks occurred during a storm and there
25 were puddles in it, you wouldn't go up and pump water
26 out 24 hours a day.

27 A No, that's correct.
28 I don't believe that would be a substantial volume.

29 Q One of the other problems
30 with this, I understand, is that if you build the walls

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 of the dyke high enough to contain everything that's
2 in it, that's fine as long as the tank leaks out very
3 slowly; but if you have the bottom fall out of the
4 tank, as occurs from time to time in the petroleum
5 industry around the world, the liquid may come out very
6 quickly and may even breach the dyke.

7 A No, I'm sorry, I can't
8 agree. The bottom of the tank doesn't fall out when
9 it's on a surface.

10 Q Wouldn't your tank be on
11 pilings, or would it be right on the surface of the
12 ground?

13 A It probably would be on
14 the surface, I think, with insulated material beneath
15 it. But getting back to your question, the rate at
16 which the liquid would be discharged, the dykes, I
17 would say, would still contain the fluids.

18 Q Would you be dyking the
19 line that would lead the fluid into the plant or facility?

20 A We have not decided, I
21 can't really answer that at this time. That will be
22 decided in our engineering phase.

23 Q Would you be running the
24 lines from the tanks to the facilities, or the plant
25 underground?

26 A I would not anticipate
27 so, no, they would be above-ground.

28 Q Would they be bermed?

29 A Rather than on pilings,
30 you mean?

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 appropriate comparison?

2 A It might have some
3 relationship.

4 Q Will you be doing that?

5 A We will be examining --

6 THE COMMISSIONER: We'll have to wait till 5:00.

7 Q We could adjourn early
8 for the purpose.

9 WITNESS SCOTT:

10 A Did you want that
11 tonight?

12 Q Well, that would give us
13 a gross estimate, I suspect. It might not be very
14 accurate because you haven't thought of this in very
15 accurate terms yet.

16 A Correct.

17 Q So any taxing on local
18 resources of timber is something that we can't fore-
19 cast as far as Gulf is concerned at this stage.

20 WITNESS STAMBERG: We don't
21 see any particular taxing on local resources.

22 Q Well -- are you going to
23 use local resources?

24 A If they are available.

25 Q That's what I meant by
26 "taxing". I don't mean to be derogatory in that you
27 would necessarily use up all the timber in the area,
28 but you would anticipate using local materials if
29 they were available.

30 A If they were available.

Q But when will you be
able to tell us when you would want -- when you could

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 forecast your requirements for pilings?

2 A I've indicated probably
3 in the fall.

4 Q And have you contemplated
5 the possibility of using pilings constructed from
6 timber cleared from the pipeline right-of-way farther
7 up the Mackenzie River?

8 A No.

9 Q Would that be something
10 you would think would be sensible to contemplate?

11 A That's a possibility.

12 Q And would you be prepared
13 to enter into discussions with the pipeline applicants
14 to see if this is feasible?

15 A If it is feasible.

16 Q Well, that's what I'm
17 asking. Don't you have to talk to them to see if it
18 is?

19 A Yes.

20 Q At page 6 of your evidence
21 you talk about control mechanisms, computer control
22 systems and you state that largely your control system
23 will be by the means of two computers, an active and
24 a backup unit.

25 A Yes.

26 Q You stress the importance
27 of the backup computer and I assume that this means that
28 if you only had one there could be serious consequences
29 if it were to fail.

30 A I refer you to the last

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 paragraph on page 6 in that section.

2 "All the remote terminal units will be designed
3 so that they will be in continual control at
4 the cluster or within the gas plant in the event
5 of a communications failure."

6 Q What does "maintaining
7 control" mean?

8 A To maintain a status quo.

9 Q So that no more gas would
10 be pumped through the feeder systems, or that it would
11 be pumped through --

12 A It would normally mean
13 that it would -- that gas at the same rate would be
14 -- would flow, subject to certain over-riding pre-
15 cautionary measures, which would shut the facilities
16 in.

17 Q All right. Now I take
18 it if you had a failure of your primary computer during
19 a time of bad ice fog when it might be a situation that
20 you couldn't fly in and out of your airstrip, that
21 you'd have to devise some other transportation means
22 to get your computer back into running order. Have you
23 thought of contingency plans in that event?

24 A That's one of the reasons
25 why -- one of the main reasons why we are advocating
26 the backup computer, to have that backup support.

27 Q Well, I --

28 A I must also emphasize
29 that a computer is not associated with aircraft.

30 Q No, but the people who

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 fix computers and who bring in spare parts, I assume,
2 would come in by air.

3 A You would normally main-
4 tain sets of spare parts on location for computers.

5 Q You would agree with
6 me that it's important to put your original computer
7 back into running order as soon as possible because
8 you're left without an insurance policy in the sense
9 if you don't do so.

10 A Yes.

11 Q Now, would it be fair to
12 say that this project will be very highly automated?

13 A Yes, I would say so.

14 Q And in the processing
15 part -- that is the plant and the wells -- once they
16 are in operation in terms of numbers of jobs, I suggest
17 to you there will not be very much opportunity for
18 native employment. Do you agree with that? Or for
19 any employment, there are going to be a small number
20 of jobs on-site.

21 A There is also, in an
22 operation such as this the maintenance operation of
23 maintaining your facilities is a very essential part
24 of it.

25 Q Now maintenance, is that
26 clearing the roads and keeping the plant clean, or
27 does it mean something else?

28 A It means all types of
29 maintenance including the maintenance of equipment
30 primarily.

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 Q So mechanics' jobs?

2 A Yes.

3 Q And what others that you
4 can think of offhand?

5 A Well, I would refer the
6 jobs that we may have available during construction and
7 operation to our socio-economic panel.

8 THE COMMISSIONER: Q Mr.
9 Stamberg, you are talking about the gas plant in place
10 and the jobs it will offer to people. That's what you're
11 talking about?

12 A Yes sir.

13 Q Well, I visited the
14 gas plant at Pointed Mountain established there by
15 Amoco.

16 A Yes.

17 Q -- and I realize the
18 volumes of gas that are being produced at Pointed
19 Mountain are, I think, something like 1/20th the
20 volumes that the three plants that have been discussed
21 this week at the hearings will produce. At the gas plant
22 at Pointed Mountain I think there were four people
23 employed as operators full-time. It may have been 3½,
24 but I don't quite know how they came out to 3½, but
25 let's say four, and they were in that instance, as I
26 recall -- and this is subject to evidence we may hear
27 in Phase 4 and so on -- but I'm going on recollection
28 what was told me at the time, they were all from Edmon-
29 ton or Alberta or some place south of the 60th Parallel.
30 Those are skilled jobs, I gather. You just can't let

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 anybody run one of these things. What are the jobs
2 you're talking about that would be available to natives?
3 First of all, are you talking about jobs as operators
4 or are you talking of other kinds of jobs?

5 A I think we referred in
6 our materials specifically on page 13, to an estimate
7 of some 50 people that we could see on-site to operate
8 the gas plant, the gathering system, and the wells and
9 provide maintenance functions.

10 Q Well, the wells are
11 automated. There's nobody at the wells.

12 A The point I'm trying to
13 make, sir, is that there must be a continuous mainten-
14 ance schedule maintained on not only the plant but
15 all the facilities that you have. This requires a
16 fairly wide spectrum of people.

17 Q You mean inspecting the
18 flow lines, maintaining the network of flow lines?

19 A Yes, that sort of thing.

20 Q And you say that your
21 operation, the whole development will employ about 50
22 people full-time?

23 A That's our best estimate
24 now on-site at one time.

25 Q That would be 50 jobs,
26 or 50 times three shifts a day, or --

27 A 50 on-site at one time
28 is our estimate.

29 Q Well, just so we don't
30 misunderstand each other --

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 A What I'm saying is that
2 during the night time there would probably be relative-
3 vely few people --

4 Q You'd have a watchman,
5 that sort of thing.

6 A That's right. During
7 the day you would have , I would estimate, a lot of
8 maintenance people working not only on the plant
9 facilities but on all facilities. I agree that
10 as far as operators are concerned in a plant such as
11 this I think there would be relatively few.

12 MR. BAYLY: Q Could we turn,
13 Mr. Stamberg, to another area, and I'll refer you to
14 page 2.53 of your big book. You have under the
15 item "routes" identified three alternative staging
16 areas and these are described in the sentence at the
17 beginning of the page:

18 "Depending on the priority and the size of
19 the item, it could be shipped to Gulf Canada's
20 Swimming Point base camp, Lucas Point, and
21 intermediate staging area on the east side
22 of the Mackenzie River or directly to the job
23 staging area in Hans Bay."

24 Are all these staging areas substitutable, or in other
25 words could any one of them serve your entire staging
26 needs?

27 A Swimming Point and
28 Lucas Point are directly across the river from one
29 another, and I would say that in our initial operations
30 that those two staging points would probably be utilized

Scott, Stanberg, Guyn, Good
Cross-Exam by Bayly

1 A I would defer comments
2 on that section to our environmental panel, sir.

3 Q Now, when we're explor-
4 ing the problems that might arise with overland move-
5 ment of the heavy modules as a possible way of moving
6 them, you'll have to take into account the natural
7 instability of the terrain; is that not correct?

8 A Yes.

9 Q And you have to take
10 into account whether you decide to move them in in
11 the winter over snow roads or whether you take them
12 in over gravel roads.

13 A I think if you're talking
14 about large modules you are committed to take them in
15 over a gravel road.

16 Q Now they weigh , as I
17 understand, up to 100 tons; is that correct?

18 A More than that. They
19 could weigh up to 1,200 tons.

20 Q Up to 1,200 tons. Now,
21 if you were moving a module of anywhere from 100 to
22 1,200 tons, what sort of a road do you need? Are there
23 any roads in existence now in the general highway
24 system say of Alberta that you could use to carry
25 these things around?

26 A We are talking in terms
27 of about a 35-foot road to move a module of that nature.

28 Q 35 feet wide?

29 A Yes.

30 Q How thick?

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 How deep a pad of gravel?

2 A We have estimated about
3 seven feet.

4 Q Is that the experience of
5 moving these modules around in other parts of the
6 country that has told you that seven feet will be
7 sufficient?

8 A It's preliminary calcula-
9 tions that we've performed to date, plus observing the
10 type of system that is used in Prudhoe Bay.

11 Q Now, you feel confident
12 that comparing the terrain at Prudhoe Bay with the terrain
13 at Parsons Lake that you can make that jump?

14 A Not until we've done
15 further studies, and that's what we intend to do this
16 year.

17 Q So you've got to do soil
18 tests, among other things.

19 A We've done some and we've
20 got to do more.

21 Q And you have to take into
22 account your statement at 4.1 that says that the terrain
23 is naturally instable -- unstable, I mean.

24 A Yes,

25 Q And that may present
26 unusual problems that you haven't encountered before
27 in the moving of such heavy equipment.

28 A It's a possibility.

29 Q Well, will that determine
30 whether you move these things in the winter or the

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 summer over your gravel roads?

2 A We haven't resolved that.

3 Q Module construction, as I
4 see it in figure 2 of your evidence , begins to take
5 place in the middle of 1978, according to that bar graph.
6 Correct?

7 A Yes.

8 Q If it begins in the middle
9 of 1978, it comes in sometime during the summer of
10 that year.

11 A No, we have estimated that
12 module construction is complete and is shipped in the
13 shipping season of 1980 on that bar graph.

14 Q Now the module construc-
15 tion then takes place down south.

16 A I beg your pardon?

17 Q The module construction
18 then takes place down south.

19 A That's the assumption that
20 was made in preparing this.

21 Q All right, then you start
22 assembling the modules in the middle of 1980, somewhere
23 around perhaps -- I can't tell from that, maybe July or
24 August?

25 A Yes.

26 Q You told us you can only,
27 bring them in by water.

28 A Yes.

29 Q So if you could only move
30 them in the wintertime because of the studies you're

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Cross-Exam by Bayly

1 going to do this summer or whatever, then you might find
2 that you'd have them completed at the end -- in the
3 middle of 1980, you'd ship them by water but that
4 you couldn't move them to the site where you wanted
5 to assemble them until that winter.

6 A That's a possibility,
7 yes.

8 Q Which might mean that
9 you wouldn't have them assembled until closer to the
10 end of 1981 than you have presently projected.

11 A Not necessarily. The
12 movement of the modules -- beg pardon?

13 Q You can start a year
14 earlier, that's one possibility, I take it.

15 A What's your question,
16 sir?

17 Q I want to know why it
18 is that it won't necessarily be that your assembly
19 of the modules won't be delayed if you can't assemble
20 them -- if you can't move them until the winter after
21 you've hauled them in on the barges.

22 A Because the transporta-
23 tion of module and the loading on the docks staging
24 area that we've referred to in our plan is only about
25 a mile from the plant site. Now the movement of the
26 module from the plant site or from the dock to the
27 plant site, if it did require a winter move, I believe
28 you're talking about a matter of four to five months
29 holding the modules at the dock area.

30 Q That would take us to

Scott, Stamberg, Guyn, Good
C_{ross}-Exam by Bayly

1 to the end of 1980.

2 A That doesn't necessarily
3 mean that your project is delayed because of that
4 holding time.

5 Q You might be doing some-
6 thing else.

7 A It's a possibility, yes.

8 Q But given that it takes
9 a fixed period of time to assemble the module, and
10 that's what the bar graph appears to say on figure 2,
11 that that operation would take place starting closer
12 to the end of 1980, if you had to move these along
13 the special road in the wintertime.

14 A If you couldn't impro-
15 vise to circumvent the time to set the modules on
16 the pile and interconnect them, you would be delayed
17 by the four months or so that you would be waiting
18 until freezeup, I grant you.

19 Q All right, and do you
20 know whether you're going to be able to assemble these
21 in the wintertime? Is that going to present any
22 problems to you?

23 A Not that we're aware
24 of.

25 Q But have you ever tried
26 it?

27 A No.

28 Q And you'll be looking
29 at the experience, I take it, that they're having in
30 Prudhoe Bay with some interest to see whether the

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Cross-Exam by Bayly

1 schedule you've outlined in figure 2 is a realistic one.

2 A Right, very much so.

3 THE COMMISSIONER: Q Mr.

4 Stamberg, figure 2, the Parsons Lake project schedule
5 in the year 1976 you have a line drawn that appears
6 to be somewhere in the fall of '76 indicating approval
7 of the Arctic Gas project. That seems to leave an
8 invidious implication regarding the Foothills project,
9 not to mention the views of those who are opposed to
10 a pipeline. But anyway, then you have what appears to
11 be January 1st, '77 approval by Indian Affairs &
12 Northern Development of the Parsons Lake project
13 itself. What were your reasons for including those
14 dates for approval of the Arctic Gas project and
15 approval by the Department of Indian Affairs &
16 Northern Development of --

17 A Can I refer that reply to
18 Mr. Scott, please?

19 THE COMMISSIONER: Yes.

20 WITNESS SCOTT: Mr. Commis-
21 sioner, in our optimistic way of doing business we
22 are hopeful that the various regulatory bodies would
23 approve it and it's necessary for those approvals
24 to come in roughly that time frame in order for us to
25 commit to construction. We would not commit to any
26 construction until there were the appropriate approvals.

27 Q All right, so that if
28 the Arctic Gas project isn't approved by something like
29 what appears to be September or October, 1976, then
30 this schedule in figure 2 is not one that can be met.

Scott, Stamberg, Guyn, Good
Cross-Exam by Bayly

1 It would have to be postponed by a year at least.

2 Would that be so?

3 A October '76 there is
4 some leeway in there, but you know, give or take three
5 or four or maybe even five months, but I think beyond
6 that your statement is correct. There are some basic
7 conditions which must be met for us; first of all
8 we have to have the gas, secondly we have to have a
9 transportation system to get the gas out, and without
10 either one of those we don't do anything.

11 Q Well, all right, we're
12 talking about the transportation system and your
13 assumption in preparing this schedule was that the
14 transportation system, i.e. the pipeline, would be
15 approved sometime about September or October, 1976.
16 You said you had to have the gas. Don't you have the
17 gas?

18 A Our current drilling
19 program, we hope, will give us the confidence that
20 we need in our reserve estimates. We are reasonably
21 confident it is there, yes.

22 Q When will that drilling
23 program be completed?

24 A There are four wells
25 currently being drilled. I guess our estimate now
26 would be what -- the next one to two months?

WITNESS STAMBERG: Yes, sir.

27 Q So it won't be for an-
28 other month or two you won't be able to tell the
29 government, the Energy Board, or this Inquiry for
30 another month or two whether you will even have the

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Cross-Exam by Bayly

1 gas to justify going ahead with this project.

2 WITNESS SCOTT: That's correct.

3 Q And where is the drilling
4 occurring that you hope will produce sufficient gas
5 to enable the project to go ahead?

6 A Four wells are currently
7 being drilled at the cluster sites that are indicated
8 in the proposal.

9 Q That's in figure 4, eh?

10 A Yes sir.

11 Q Where are the wells be-
12 ing drilled again?

13 A Clusters 1 through 4.

14 Q Oh, I see, right.

15 A One well at each cluster
16 site.

17 Q Yes.

18 A If I could just add an-
19 other comment, Mr. Bayly, of course, is indicating
20 scheduling problems and of course we fully appreciate
21 that. That's why we need the kinds of things at the
22 front end that we're talking about so we can get on
23 with the business.

24 Q Oh, I'm sure we all
25 understand that. We understand and sympathize with
26 your problems. We're just trying to understand them
27 fully.

28 A So are we.

29 MR. BAYLY: Mr. Commissioner,
30 I understand that Mr. Marshall wants to make a motion

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Cross-Exam by Bayly

1 about some of my evidence so that he could do so and
2 also pick up his wife at the airport, I am prepared
3 to stop now and let him take up the rest of the day
4 with that.

5 MR. BALLEM: Mr. Commissioner,
6 just before that can I make one brief comment which
7 may be helpful with respect to the socio-economic
8 panel which will be coming along in the next two or
9 three days?

10 THE COMMISSIONER: I hope
11 we'll reach them tomorrow morning, won't we?

12 MR. BALLEM: No, that's the
13 environmental, sir.

14 THE COMMISSIONER: Oh, that's
15 right.

16 MR. BALLEM: We did, way back
17 in November, 1974, as part of the material that we
18 made available to the Commission, file the report by
19 Van Ginkel & Associates which dealt with the
20 communities of the Mackenzie, or a title similar to
21 that. That was essentially a CAGSL report. They commis-
22 sioned it and it includes about 16 communities, many
23 more than the ones that are affected by our operations.
24 Our only contribution to that in essence was to
25 participate in the funding of it. We -- and I'm just
26 saying this for the benefit of those who might be
27 preparing cross-examination -- we will not be including
28 in the socio-economic panel a witness from Van Ginkel,
29 and it is not our intention to in any way refer
30 or rely upon that report. It is my understanding, which

1 Mr. Marshall can confirm, that CAGSL do intend to
2 introduce that and other Van Ginkel reports, and I
3 believe the witnesses from that firm in Phase 4. But I
4 just wanted to make that observation so we don't have
5 people wasting time over the weekend.

6 THE COMMISSIONER: Yes.

7 That would be a shame if that were to occur.

8 MR. BALLEM: Yes, indeed.

9 There are better things to do on this long weekend we
10 have.

11 (WITNESSES ASIDE)

12 THE COMMISSIONER: Mr. Marshall?

13 MR. MARSHALL: Thank you, sir.

14 I hesitate to interrupt Mr. Bayly in his cross-
15 examination, as I had hoped that if we let him run to
16 the end of the day he might finish today. He had
17 discussed this matter with me and thought it would be
18 best if I brought it on before he brought his witness
19 up.

20 Sir, as you are aware, or
21 perhaps are aware, Mr. Bayly has circulated some of
22 the evidence for the witnesses he proposes to call
23 next week. Among that is the evidence of Mr. D.R.
24 Shaw. I've now had an opportunity to review it and
25 it strikes me, sir, that it is not relevant to the
26 work of this Inquiry. The title of the evidence is:

27 "Handling of hazardous materials in oil and
28 gas field development in Alberta."

29 Now, sir, I realize that this is not a regulatory
30 proceeding in the traditional sense and that you as

1 an Inquiry officer can consider a very wide range of
2 evidence in order to enable you to make your recommen-
3 dations to the Minister. However, I suggest to you,
4 sir, that while interesting, Mr. Shaw's evidence will
5 not assist in advancing the work of the Inquiry,
6 particularly as it relates to recommendations of
7 appropriate terms and conditions for a gas pipeline
8 right-of-way. Accordingly, you may wish, with the
9 advice of Mr. Scott, to consider whether or not you
10 would like to hear this evidence which is quite
11 lengthy and quite technical.

12 Thank you ,sir, that's really
13 all I had to say about it.

14 MR. BAYLY: Mr. Commissioner,
15 I had provided a copy of the evidence to Miss Hutchin-
16 son.

17 THE COMMISSIONER: She just
18 handed it to me.

19 MR. BAYLY: And I don't know
20 whether it's appropriate to make submissions now, sir,
21 or wait until you've had a chance to have a look at
22 the --

23 MR. SCOTT: Well, Mr. Commis-
24 sioner, may I ask a question of Mr. Marshall: Is he
25 moving that this evidence not be heard? Because if
26 he is then there's something to deal with. If he's
27 not, and his last observation didn't indicate that
28 he was, we can really pass on, having noted his
29 reservations. Is Mr. Marshall --

30 THE COMMISSIONER: Well, I got

1 the feeling that he was saying it was not relevant
2 to the issues before the Inquiry and that Mr. Shaw
3 should not be sworn.

4 MR. SCOTT: Well, he didn't
5 go that far. I'm just giving him one more chance to
6 recant. It seems to me if he doesn't go that far,
7 there's nothing to deal with.

8 MR. MARSHALL: I thought the
9 comments had been carefully worded to entrap Commission
10 counsel. I wanted to see if he would be prepared to
11 take a position one way or the other for a change,
12 indicating whether or not he felt they were subjects
13 that were relevant to the Inquiry, or subjects that
14 were not relevant to the work of the Inquiry, and
15 accordingly I put my comments on the basis that you,
16 sir, may wish to consider with Mr. Scott's advice, on
17 which you undoubtedly rely in these matters, as to
18 whether or not you feel it would be worthwhile to
19 the Inquiry to devote what may be a considerable
20 amount of time in consideration of the evidence of
21 Mr. Shaw.

22 I should add, though, that
23 the time might be shortened somewhat inasmuch as I
24 feel that as the evidence is irrelevant to what we
25 are here for, I won't have any questions on it. But
26 you may feel, sir, that we ought to be moving on to
27 things that are more germane.

28 That is, I suppose, Mr.
29 Scott, that is a motion that the evidence be excluded.
30 Put it on that basis. I'm not urging that strongly,

1 sir, obviously I feel you can consider what you think
2 is necessary to the work of the Inquiry and it seems
3 to me that this isn't really going to help us get to
4 the matters that are in issue.

5 THE COMMISSIONER: I see your
6 point.

7 MR. BAYLY: Mr. Commissioner,
8 I'd like if you are looking this evidence over, for
9 you to consider it in light of the fact that we have
10 heard evidence to date that suggests that there may
11 be formations found that contain both oil and gas,
12 and that your guidelines do contemplate the possibility
13 that the corridor that is used to transport gas may
14 also be used to transport oil and that a large part
15 of the evidence of this witness is related to problems
16 in hydrocarbon processing and gathering fields and
17 it isn't restricted to oil, and that when you are con-
18 sidering the functions of the Inquiry and the assess-
19 ment of impacts on this region from an environmental
20 point of view, as well as from the other points of
21 view we were discussing, that this evidence seen in
22 those lights may be not only relevant to you, sir,
23 but may be relevant to the people living in this
24 area that it be heard by them, and that is one of the
25 values of a public Inquiry. But the test being that
26 it must be relevant to the subjects which you may
27 consider and it's not as though I have gone as far as
28 to take the possible development of hydro-electric
29 projects or mining developments that may follow this.
30 I have restricted this evidence to those matters that

1 are contained in the guidelines.

2 THE COMMISSIONER: Not forgett-
3 ing the railway.

4 MR. BAYLY: I don't think I
5 have any evidence on railways.

6 MR. SCOTT: And that's about
7 all you don't have evidence on.

8 THE COMMISSIONER: I'm told
9 the railway would virtually clean out the gravel so
10 we wouldn't have that to worry about.

11 MR. BAYLY: In any event,
12 I'm grateful to my learned friend for bringing this
13 on prior to my bringing this witness here, and for
14 that reason it is of some importance to my planning
15 that there be some ruling on it prior to the end of
16 the weekend, sir.

17 THE COMMISSIONER: Well,
18 that's, I think, in all respects, the appropriate way
19 to proceed.

20 Establishing appropriate
21 limits to the scope of this Inquiry is not easy. The
22 evidence we've heard has made it plain that if the
23 gas pipeline is built it will act as a stimulus to
24 oil and gas exploration in the delta, in the Beaufort
25 Sea. The guidelines proceed on the assumption that
26 if a gas pipeline is built, an oil pipeline will
27 follow, that we will have an energy corridor along
28 the Mackenzie Valley, and this Inquiry has two things
29 to do: (1) is to report to the government on the
30 social, economic, and environment impact of a gas

1 pipeline followed by an oil pipeline in the context
2 of the Mackenzie Valley transportation corridor, and
3 then to recommend terms and conditions to be imposed
4 if a gas pipeline is built.

5 If you build a gas pipeline
6 then it's clear there will be enhanced oil and gas
7 exploration activity and the consequences of that
8 enhanced oil and gas^{exploration} activity in the delta and the
9 Beaufort Sea are clearly within our impacts of
10 pipeline construction. If you don't build a pipeline
11 you won't get the oil and gas exploration extending
12 over the delta and into the Beaufort Sea. I think it
13 is a case of two and two makes four.

14 But having said that and
15 that's essentially what I said in opening the hearing
16 at Inuvik on Tuesday, it is still not an easy business
17 to define those limits that we should set so far as
18 our investigation of the consequences of pipeline
19 construction and corridor development are concerned.
20 So I think I had better, having laid out in outline
21 the limits of our examination of the consequences
22 of pipeline construction and corridor development,
23 insofar as the oil and gas exploration activity it
24 will precipitate in the delta and the Beaufort Sea
25 is concerned, having laid out the limits in a general
26 way of our investigation of the matter I think I
27 will -- and I expect counsel to be guided by those
28 limits that I laid out generally -- I'll examine Mr.
29 Shaw's -- the statement of Mr. Shaw's evidence over -
30 night and advise you in the morning. Will that be

1 time enough?

2 MR. BAYLY: Yes, it will, sir,
3 and one of the things I didn't mention in my response
4 to Mr. Marshall's motion and one of the dangers that
5 may arise from this kind of motion is that if there
6 are things -- and I don't say there are, but should
7 there be things in his evidence which aren't relevant,
8 there may be a way of eliminating those without
9 eliminating all the evidence, because if that were
10 the case then on the basis of a single question and
11 answer a witness's entire testimony could be struck.
12 So I ask you to consider that as an alternative if
13 you do feel that some of the matters have gone beyond
14 the scope of your Inquiry.

15 Mr. Marshall may tomorrow
16 want to suggest what those things are that he objects
17 to. I'm assuming he doesn't object to the whole thing.
18 We've already discussed some of the matters with
19 these witnesses and the preceding ones for the pro-
20 ducers, and he made no objection.

21 MR. MARSHALL: Well, sir,
22 that's probably because of a New Year's resolution
23 brought on at the urging of Commission counsel to keep
24 my objections to a minimum. But I don't think by
25 not raising an objection to a question asked a panel
26 called by another participant or a guest of the
27 Inquiry I'm waiving my right to take a position in
28 argument that certain subject areas aren't relevant
29 to the Inquiry.

30 Now I've given some thought to

1 this question of whether or not one could excise from
2 the material filed, those parts which seem to me at
3 least not to be relevant, and I thought of that parti-
4 cularly with respect to the evidence of the other
5 witness, whose evidence I have, Mr. Shearer. However,
6 in this case --

7 THE COMMISSIONER: What is
8 Mr. Shearer's evidence about?

9 MR. BAYLY: Gas development on and
10 offshore of the Beaufort Sea. MR. MARSHALL: The possible
11 scenario of future petroleum development in the
12 Western Arctic, sir.

13 With respect to Mr. -- I
14 don't wish to speak to that evidence now, sir.

15 MR. BAYLY: Well, Mr.
16 Commissioner, if he doesn't wish to speak to it now --

17 THE COMMISSIONER: All right,
18 let's allow Mr. Marshall to have the --

19 MR. MARSHALL: With respect
20 to Mr. Shaw's evidence, sir, I think overall it's
21 not relevant, and --

22 MR. BAYLY: Well, Mr. Commis-
23 sioner, my first witness, as I told Mr. Marshall,
24 is going to be Mr. Shearer. So if he's got any
25 objections to his evidence I would suggest that he
26 makes them now. He's had that evidence for enough time
27 to know whether he has any objections to its relevance
28 and I don't want to bring him up here if you're going
29 to rule against that witness as well. We're faced
30 with limited funding. I have some other bits of

1 evidence too and perhaps Mr. Marshall will --

2 MR. SCOTT: Did my friend
3 say "unlimited funding"?

4 I just heard the
5 Minister's statement this morning. I was very impressed

6 MR. MARSHALL: Sir, I haven't
7 seen the various slides and tables to go with Mr.
8 Shearer's evidence and I really have no opinion on
9 that to give. If I had a chance to look at them,
10 and Mr. Bayly has said they'll be made available, I
11 should be able to make up my mind tomorrow, and if
12 I intend to bring ^{on} an application naturally I'll bring
13 it on before he brings his witness up.

14 MR. BAYLY: Well, Mr.
15 Commissioner, the other matter, and that is related to
16 Mr. Marshall's failure to object to evidence coming
17 in from other participants. I would submit that if
18 he's content that it comes in from the producers upon
19 whom he will be relying for gas, that it's unreason-
20 able to expect that he should only be allowed to
21 object to its relevance if it comes in from people
22 who may be opposed to or not at least aligned with
23 the project that he is proposing.

24 MR. HOLLINGWORTH: Well, sir,
25 it seems to me that the objections of cross-examination
26 by one participant of another by yet a third party
27 is completely different from an objection to evidence
28 in chief coming before you in the printed fashion two
29 weeks in advance in this manner. I have to agree
30 with Mr. Marshall totally on that. Surely I don't

1 have to object to the manner in which cross-examination
2 is being presented by someone else in order to protect
3 my rights later on.

4 MR. BAYLY: Perhaps, Mr.
5 Commissioner, I should make it clear that in the event
6 that Mr. Marshall is objecting to Mr. Shearer's evidence
7 that it's on subjects similar to those raised by
8 Mr. Horsfield in his direct evidence and there was no
9 objection that I recall by either Mr. Hollingworth or
10 Mr. Marshall to that evidence when it was given.

11 THE COMMISSIONER: All right.
12 I really think that this three-cornered argument has
13 to be brought to an end. Whether you objected to
14 a question put in cross-examination has no bearing
15 on whether subsequently you are foreclosed from making
16 an objection to that whole line of evidence being
17 brought up, so that I agree with Mr. Marshall and
18 Mr. Hollingworth. I thought that was your position.
19 Maybe I'm not agreeing with you but that's the way
20 I feel about it.

21 MR. SCOTT: Mr. Commissioner,
22 can I suggest the following course of action? You
23 reserve to indicate that you will rule on Mr. Marshall's
24 submission about Mr. Shaw's evidence tomorrow morning.
25 If there are any other motions to be made, then they
26 can be dealt with tomorrow morning as well. The
27 demeanor of my colleague indicates that the small
28 hand is on five and the large hand is on 12.

29 MR. BAYLY: The large hand is
30 on two.

1 THE COMMISSIONER: Well, could
2 I just mention one or two things that you gentlemen
3 have raised, because they are important?

4 Let me say that on the basis
5 of what Mr. Bayly has indicated will be the subject
6 of Mr. Shearer's evidence, it seems to me it falls
7 squarely within, subject to what Mr. Marshall and
8 Mr. Hollingworth may say, it seems to fall squarely
9 within the rulings that I laid down and the views I
10 expressed in opening the hearing on Tuesday morning,
11 and it seems to me Mr. Shearer's evidence relating
12 to the possible course of oil and gas development in
13 the Western Arctic would be complementary to Mr.
14 Horsfield's evidence -- not complementary, but it
15 deals with the same subject matter; and having heard
16 Mr. Horsfield, I think it unlikely that I would refuse
17 to hear Mr. Shearer, but if Mr. Marshall pursues the
18 matter in the morning we'll deal with it then.

19 The question of this evidence
20 of Mr. Shaw, what troubles me isn't so much the matter
21 of relevance, speaking in the strictest sense, because
22 it clearly lies within the periphery of the consequences
23 of oil and gas development; but we will have to
24 impose a limit upon the extent to which we in this
25 Inquiry can seek to identify and atomate all of the
26 possible problems that oil and gas development might
27 bring in its wake. That's what concerns me and that's
28 why I'd like to consider that.

29 Let me just return to this
30 question of the course that oil and gas exploration

1 may take and where discoveries may occur. We spent
2 the last three months in Yellowknife considering
3 environmental evidence and one of the last witnesses
4 we heard was Mr. Templeton, of the Environment
5 Protection Board, he said he favored the interior route
6 to bring Alaskan gas to the main trunkline up the
7 Mackenzie. He favored the interior route over the
8 prime route on the coast. He might be right about
9 that; he might be wrong. We've heard a lot of
10 evidence about that and we may hear some more.

11 Dr. Bliss, who gave evidence
12 here on Tuesday, appears to favor the coastal route,
13 and he is a colleague of Mr. Templeton's on the Board.
14 But Mr. Templeton had a reservation that seems to
15 me we're obliged to explore. If the Inquiry were to
16 accept the arguments of those who say that the environ-
17 mental impact on the coast would be greater than
18 it would be on the interior route, then the Inquiry
19 would have to advise the government. That would be
20 a finding the Inquiry would make, and what the Inquiry
21 at the same time has to look beyond this gas pipeline
22 to see if we can determine the outline of development
23 that may come after a gas pipeline because if the
24 North Coast of the Yukon, if the North Coast of the
25 Yukon were to be protected, as Mr. Templeton has urged,
26 and Dr. McTaggart-Cowan has urged, and as many others
27 have urged, to safeguard the Porcupine caribou
28 herd and the large populations of birds that nest
29 there and use the coast as a staging area. If the
30 North Coast were to be safeguarded in that way and

1 if the Inquiry were to report to the Federal Government
2 that the interior route is the route where the pipeline
3 ought to be built, and I'm speaking hypothetically--
4 some of you may have accompanied me to Old Crow last
5 summer when we heard the views of the people of Old
6 Crow about the idea of building a pipeline along the
7 interior route --but if we were to avoid the North
8 Coast and then the course of exploration and discovery
9 took a line, so to speak, west into the Beaufort Sea
10 along the coast it may be that a gas pipeline or an
11 oil pipeline might have to be built along the coast
12 in years to come, and the avoidance of the coast in
13 the building of this gas pipieline would have turned
14 out to be of no lasting consequence. So that's
15 why, let me say I know all of the parties here have
16 their reasons for putting evidence forward, but that's
17 one of the reasons I have for wanting to hear the kind
18 of evidence we heard from Mr. Horsfield and the kind
19 of evidence that I take it Mr. Shearer is going to give

20 This is an inexact sort of
21 business but we have to do the best we can. So we'll
22 adjourn until 9:30 in the morning.

23 (PROCEEDINGS ADJOURNED TO JANUARY 24, 1976)
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